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CONTENTS

The Work of the Council on Pharmacy and Chemistry of the American Medical Association: PROFESSOR J. H. LONG 889

The Twofold Function of the University: PROFESSOR FRANK ALLEN 901

A Comparison between Fraternity and Non-fraternity Expenses at the University of Illinois: DR. C. H. FORSYTH 911

Mr. Carnegie's Trust Fund for Promoting Peace 913

Scientific Notes and News 914

University and Educational News 916

Discussion and Correspondence:—
Calendar Reform: PROFESSOR CYRIL G. HOPKINS. *Amœba meleagridis:* DR. PHILIP B. HADLEY 917

Quotations:—
Women and Scientific Research 919

Scientific Books:—
Schuster's Introduction to the Theory of Optics: PROFESSOR HENRY CREW. *Schwarz's Causal Geology:* PROFESSOR FRANK D. ADAMS. *Titchener's Text-book of Psychology:* PROFESSOR JOSEPH JASTROW 920

Louis Agassiz's Later Views on the Classification of Fishes: DR. L. HUSSAKOF 925

The Synthesis of Formaldehyde by Light without Chlorophyll: PROFESSOR A. P. MATTHEWS 926

Special Articles:—
The Distribution of some Pennsylvania Fishes: DR. HENRY W. FOWLER 926

The Convocation Week Meetings of Scientific Societies 927

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ON THE WORK OF THE COUNCIL ON PHARMACY AND CHEMISTRY OF THE AMERICAN MEDICAL ASSOCIATION[1]

AMONG the many reforms which have sprung up in the last few years and have grown in a modest way one may be mentioned which, while of great practical value to the public, has appealed first and directly to medical men only, and has therefore been generally overlooked by the people at large. To understand the genesis of this reform a few words of history will be necessary.

We do not have to go back very far to recall a time when a marvelous faith was placed in the power of drugs to cure or alleviate all manner of ills. Many of these drugs were of the crudest description, and were often extracts or tinctures of various barks, roots or leaves of somewhat uncertain composition, used alone or in combination with certain inorganic, and a few organic salts. The use of these things was an inheritance and also a development from older usages, going back to the materia medica of the disciples of Galen, on the one hand, or to the mineral chemistry of the followers of Paracelsus, on the other. In spite of the advance of knowledge the pharmacopœias of the nineteenth century contained a great deal of rubbish, the weeding out of which has been a difficult task.

In consequence, however, of the rapid advance of knowledge a gradual distrust of the value of the great majority of drugs, and indeed of drugs in general, began to appear among medical men. The situation was described as one of therapeutic nihil-

[1] A paper read before the Evanston Scientific Association, November 4, 1910.

ism, and, like all nihilism, was an unjustifiable extreme. It is, of course, true that a great number of the remedies used by physicians of fifty years ago were either inert or incapable of producing the results claimed for them, but the gradual recognition of this fact should not have occasioned a blindness as to the actual value of others which are still employed, and with demonstrable worth.

Another fact which contributed not a little to the growing distrust among physicians of the efficacy of drugs was the very marked development of the patent medicine business, and its peculiar exploitation through the daily press. Many of the so-called patent medicines were simply prescriptions which had enjoyed some local popularity for particular ailments. Turning them into cure-alls, while serving to catch the public, would naturally condemn them among the great body of physicians, and with them many other remedies used for the same purposes. The condemnation of patent or proprietary remedies by physicians was naturally ascribed to jealousy, and the fear of losing business. The doctors' attitude was classed as a trade interest and the newspapers which profited by advertising patronage took care not to dispel this notion, which was often a false one.

This ugly situation soon became worse by the entrance of another factor. While the greatest triumphs of organic synthetic chemistry were first in the color industries, it was in time shown that many of the coal tar derivatives possessed marked physiological properties which might give them value in medicine. The developments in this direction were enormously rapid. Recall what has been done in twenty-five years! In the efforts to produce artificial alkaloids with the properties of quinine a number of aromatic synthetics were developed. The first of these was known as kairin, a quinoline derivative, with some good properties, but having certain secondary actions rendering it risky in use. A host of others followed, and great factories were soon engaged in the manufacture of artificial products, mostly coal tar derivatives, for use in medicine. In the twenty years following the introduction of kairin not far from 2,000 of these had been advertised to the medical profession. Most of them were soon found to have little practical value, but more came on and they are still coming. All classes of important remedial agents have been represented; antipyretics, local and general anesthetics, hypnotics, intestinal and external antiseptics, and a great variety of bodies with special physiological properties.

It is not hard to imagine the result. The most extravagant claims were made for many of these new compounds, and it was indeed an able and independent physician who could dare to refuse to be imposed upon by their promoters. Unfortunately, the great body of medical practitioners the world over soon fell victims to the craze for "synthetics," either in their original form as they came from Germany, or in the form of imitations or mixtures as put out by other houses. It is not too much to say that the use of many of these newer remedies soon became a veritable scandal. Of rational therapeutics little was left, and, apparently confused by the wealth of things offered, physicians were often only too willing to follow the advice of the agents of the medicine houses. Acetanilide alone has made millions for those who have pressed it in a business way, under new names. As acetanilide its value and also its dangers soon became known to the body of physicians, as a whole, and in this form it is safe to say that its use has seldom been excessive. But mixed with a

little caffeine and soda as antikamnia, and praised as an original and newly discovered synthetic, it soon found a market where it was sold in enormous quantities. Chemists pointed out the facts, but physicians were easily duped, and some departments of the United States government even bought antikamnia for their hospital stores. The fortunes made in this product stimulated a dozen or more imitations, and ammonol, orangeine, phenalgin, salacetin and other mixtures containing acetanilide as the chief active constituent were soon on the market, advertised as new and valuable remedies. Most of them, like the antikamnia, contained caffeine.

That a new remedy hailed from Germany, and that its use was backed up by the favorable opinion of almost any doctor of that country was considered sufficient to justify its use here, where therapeutic experimentation had sunk to the level of trying almost everything which came along.

The business of manufacturing proprietary remedies ready for use grew to enormous proportions, and unfortunately the main element in selling many of them was the air of mystery with which they were surrounded. In the old materia medica, while the situation was bad, it was not so entirely hopeless. The average physician had always seen and certainly knew something about calomel, cinchona and opium, but the things with the long high-sounding names, made in Germany, were clearly beyond him. He naturally and easily dropped into the position where the pseudo-scientific jargon of the glib-tongued detail man of the medicine factory overpowered him.

I am talking of the position of physicians, as a class, but fortunately there was a saving remnant. Not all of our American practitioners were fooled by the campaign of advertising madness. Not all of them were swamped by the flood of proprietary remedies which flowed from the medicine factories in an ever-increasing stream. A remnant remained to attempt the saving of therapeutics and the wiping out of the disgrace of proprietary enslavement. In this remnant were a number of men active in the councils of the American Medical Association and they were sufficiently alive to the seriousness of the situation to undertake a reform. The *Journal* of the association was the medium through which the reform was begun and primarily, perhaps, because here the need became the most apparent. The *Journal* has had a wonderful growth in the last two decades and much of our best medical research is published in it or reviewed by it. At the same time in its advertising columns the praises of some of the worst products of the medicine factories were sounded. The incongruity of the situation was apparent. Where is the sense, it was asked, in advocating modern and scientific therapeutic measures, supported by pharmacological evidence, if but a few pages away a dozen *ols* and *ins* and *phens* are advertised in exaggerated terms, and about which no man knows anything. This irrational relation should be reformed, but how?

The way in which the reform was effected and the far-reaching consequences of the same developed somewhat slowly. The editor began by consulting a small group of chemists and pharmacists regarding the possible or probable merits of a number of substances offered for advertisement, with the hope of developing some scheme by which objectionable matter might be easily weeded out. Naturally the editor and the advertising manager of a journal could not be expected to pass on the reasonableness of the claims for a complex new synthetic. This is the province of men trained in chemistry and pharma-

cology. In these consultations it was soon recognized that it would be possible to reject many articles on account of glaringly false statements made. As contracts for some doubtful products expired the manufacturers were informed that they would not be renewed until the truthfulness of the claims could be investigated. To investigate such claims and others growing out of the work it was seen that a committee or council would be necessary, and the composition and functions of such a body were the subjects of many conferences between men interested in the outcome of the work. Finally, the Council on Pharmacy and Chemistry was organized in the spring of 1905 and this body after much correspondence and a number of meetings formulated rules of procedure.

It was seen at the very outset, however, that the work of the council should not be limited to the study of medicines advertised in the *Journal* of the American Medical Association, or there offered for advertising, but should embrace an investigation of all new articles advertised to physicians, the results of the investigations to be published in the *Journal* and later in book form under the title of "New and Non-official Remedies." It was understood, however, that the studies of the council could not be extended to the thousands of products advertised in the lay press to the general public. Many of these articles are little better than frauds, to be sure, but the work of the council could not be made to include them. As an almost necessary limitation it was agreed that the studies and investigations of the council should be devoted to the articles advertised to physicians only.

As it was first organized the council consisted of twelve men, divided into three groups or committees, on chemistry, pharmacy and pharmacology. The present membership embraces sixteen men, a new group, therapeutics, having been added. As it has been my privilege to be a member from the time of organization I can best explain the work accomplished by speaking in the first person. The membership of the council is made up by vote of the trustees of the association and the appointments are for a term of years. The present membership includes the following men and it will be seen that there is a fair geographical distribution, as well as institutional representation: J. A. Capps, Rush Medical College; D. L. Edsall, University of Pennsylvania; Otto Folin, Harvard Medical School; C. S. N. Hallberg, University of Illinois School of Pharmacy; R. A. Hatcher, Cornell University; Reid Hunt, Hygienic Laboratory of the Public Health and Marine Hospital Service; L. F. Kebler, U. S. Department of Agriculture; J. H. Long, Northwestern University; F. G. Novy, University of Michigan; W. A. Puckner, Laboratory American Medical Association; J. O. Schlotterbeck, University of Michigan; G. H. Simmons, editor *Journal* American Medical Association; Torald Sollmann, Western Reserve University; Julius Stieglitz, University of Chicago; M. I. Wilbert, German Hospital, Philadelphia; H. W. Wiley, U. S. Department of Agriculture.

Meetings of the whole body are held at frequent intervals and there is an annual meeting in Chicago. Most of our work is naturally done by correspondence and by the circulation of a weekly bulletin. It must be added that the services of the council are without any compensation.

It is well known that acetanilide, or phenylacetamide, is a very powerful and at the same time a somewhat dangerous remedy. It is much used by physicians, but as so employed in the free form has seldom caused fatal results. Not so, how-

ever, when it is dispensed under a misleading name in quantities beyond the safety limit. Most of the headache cures sold in tablets so freely in the last few years contain acetanilide, and because they are advertised as safe they are often used in excessive amounts, with sudden death as an occasional consequence. Five years ago many of these headache cures were distributed from house to house in free samples and they were advertised in the medical and the lay press. Several of them were manufactured by companies which had grown rich in the business, and it was recognized that the companies might fight our efforts. To show our own strength and interest in the matter and determine just what could be actually done we decided to take up this difficult problem first, and therefore began examinations of the products known as antikamnia, salacetin, ammonol, orangeine, Koehler's Headache Powders and phenalgin. These things had been paraded as discoveries of rare value and true and new synthetics, in some instances. In the advertising literature of some of them the dangerous acetanilide was warned against.

As was to be expected the work of our committee showed that each one of these highly praised cures contained acetanilide as its main constituent, and usually in combination with caffeine and sodium bicarbonate. In the samples of the several products as bought in the market the amounts of acetanilide ranged from 43 to 76 per cent. The report of the council was signed by the five men on the committee of chemistry, Long, Puckner, Sadtler, Stieglitz and Wiley, the work having been done in the five laboratories represented, and independently. This report was published in the *Journal* of the American Medical Association, June 3, 1905.

It is putting it mildly to say that the publication of the first report, taken with the previously announced program of the council, created consternation among the manufacturers of dishonestly advertised proprietary remedies. Abuse came to us from many quarters and articles were sent out to physicians all over the country denouncing the presumptuous work of an irresponsible council which should undertake to tell physicians what they should or should not use. St. Louis has long been the home of a large number of fake medical preparations and from that city a vicious pamphlet was sent out by the thousands under the euphonious title "The Arrogance of Ethics," in which the *Journal* of the American Medical Association, its editor and the Council on Pharmacy and Chemistry were severely handled on account of the meddlesome work they had undertaken.

Certain interests associated with the acetanilide exploitation even went so far as to threaten law suits against us. The suits, however, were never started. Our committee would have found pleasure in defending them. Two firms in other lines, seeing what had been done for acetanilide, notified us through their lawyers not to publish anything concerning their products. This advice was wholly unnecessary as far as one of the products, bromidia, was concerned, as the method of advertising it made a study unnecessary. Some of the products of the other firm have since been examined and condemned. The council has no fear of punishment for any work it is doing, which, as mentioned, is absolutely voluntary and without compensation.

Our work was now pushed vigorously, and to make plain its basis it is necessary to explain the sources from which the physician draws the remedies he prescribes. These sources may be classed as follows:

(*a*) There is first the "Pharmacopœia

of the United States," which is a work revised every ten years and which contains descriptions and formulas for remedies that have been so long in use as to be considered as standard. There is no secret about their preparation and they may be made and sold by any one. But the fact that they are contained in the "Pharmacopœia" does not mean that they are valuable remedies. In fact, many of them are not. The preparations of the "Pharmacopœia" are called official and the book has legal standing in the United States.

(*b*) We have next the so-called "National Formulary," which is a compilation of remedies selected by the American Pharmaceutical Association. The articles described here have not the wide use of those in the "Pharmacopœia." Some of them are new remedies not fully tried out and some have more of a local reputation. Many of them are good and valuable, and many are not, but their use is sanctioned by the experience of many physicians, apparently.

(*c*) Third, the so-called "ethical" proprietary products, which are made by processes in a measure secret, or owned by the producing firms. Many of these products are new organic compounds of great physiological activity, while some are mixtures or combinations of long known remedies. Some are good, and some, on the other hand, are bad, even very bad. But as long as these products are made for and advertised to physicians only they have been called ethical as distinguished from the ordinary "patent" medicines which are sold to everybody, and not usually on the prescription of a physician. Many of the manufacturers of this group of products make a point of the ethical character of their wares, the test of "ethicity" being essentially in the method of advertising. A remedy which is advertised directly to the public, as are the ordinary patent medicines, is said to be unethical, while one which is described in the professional journals for the eye of the physician only is supposed to be ethical. At least this is the way some of the manufacturers interpret the criterion.

If to be ethical it is simply necessary to advertise in medical journals only, it is very easy to keep within the ethical pale. To publish one's own medical journal is all that is called for, and it may occasion surprise to learn that probably half a dozen journals in this country are published by manufacturers to advertise their products. This fact is not stated on the title page, however. Some of these publications have a subscription list, others not. One of the worst of these comes from a small town in Connecticut. The reading matter in them consists of articles purporting to give the experience of the writers with the various remedies lauded in the advertising pages. In this simple way many worthless products become ethical proprietaries. But it must be admitted that many medical journals of greater pretensions are not much better in their advertising matter.

(*d*) We have, finally, the large group of patent medicines, which are not really patented in the usual sense of the term. The name under which they are sold is ordinarily copyrighted, and their success depends on wide advertising to the general public through the daily press. Many of these articles are mixtures which may have had value for some specific ailment and were often originally popular prescriptions. But in the patent medicine form the composition is not disclosed, and for them much more is claimed than this could possibly warrant. In many cases they contain powerful remedies which should not be used except on the advice of a competent person. They often accomplish re-

sults, to be sure; the soothing syrup contains morphine, why should it not put baby to sleep; the headache and the nerve cures often contain enough acetanilide as the active compound to produce a sleep from which there is no arousing. It must be said, further, that in no case do they contain any remedies not well known to physicians. They are not produced by unusual skill and after long study. The only expensive thing about them is the advertising.

As intimated above, the work of the council is limited to the third group of remedies. Those of the first and second groups are well known, while those in the fourth group are unworthy of notice, as used, except to condemn. It may be urged, and has been urged, that the restriction of the free sale of patent medicines is a limitation of personal liberty, that any man should have the right to buy what he pleases. There are cases in which such right may be conceded, but not where potent or dangerous remedies are bought for administration to helpless invalids or children. Self dosage is always foolish; the dosage of others with remedies of unknown composition may be criminal.

The physician should be fully informed as to the nature of the remedies he is expected to use, and the work of the council is to furnish this information regarding all new things presented to his attention. They should not be employed on the mere guarantee of the financially interested manufacturer.

At the beginning of our work the council adopted certain rules, which if complied with, would entitle articles submitted to us to consideration and report, and to notice in "New and Non-official Remedies" in case they were found satisfactory. At first certain manufacturers assumed a very independent attitude and attempted to ignore the stand of the council, but the situation to-day is reversed and every firm engaged in the work of producing remedies to be used by physicians is glad to secure our indorsement of its products. Since our experience with the acetanilide mixtures we have been able to pass on the merits of nearly all the new remedies offered in the American market, and many of the older ones also, in the proprietary list. Up to the present time we have examined not far from one thousand compounds and those which appear to have some merit and are honestly advertised are listed and described in our publication mentioned. The publication does not, of course, imply an indorsement of the therapeutic claims.

The importance of the work of the council appears in several directions. It is constructive as well as destructive, and in its future development must lay greater stress on this point, the reasonableness of the claims made for therapeutic value. Thus far we have been mainly concerned in securing from manufacturers complete statements of composition and place of manufacture, general properties and behavior, which are controlled often by very full investigations of our own. We have insisted that in their advertising the manufacturers must abandon the practise of making exaggerated claims as to curative action, which is not only undignified, but often not in accord with facts. Doubtless in the future the work of the council will have to be more critical in this respect. We have admitted to "New and Non-official Remedies," for example, a number of lecithin preparations, but it seems absurd to think that in the quantities in which they are used in a medicinal way they can have any value as nerve or tissue builders or stimulants in nutrition. One or two eggs would doubtless contain more

of real value than several dollars worth of the lecithin preparations in the market. Of the extracts of malt, and the various predigested foods considered, something similar may be said, and probably the council will have to say it.

But in the work of exposing frauds we have rendered a service of some distinct value to the public. Of the thousand or more articles passed upon several hundred have been rejected as unworthy to find a place in our book, and therefore not suitable for consideration, even, by physicians. Thus far I have just said, our findings have been too liberal, rather than too critical. The rejections have been for various reasons and if I had the time I should like to give a list of them. But a few illustrations will suffice.

We devoted much time to the study of a so-called metabolized cod liver oil. The name is a catchy one. We all like to talk of metabolism; it sounds well and apparently means a great deal. Cod liver oil has been used through a long period as a food for consumptives, especially, and great value has been claimed for it, probably without better reasons than might be assigned for other oils. But the taste and odor are bad, which are practical objections to its use, and besides many people have trouble in digesting it, or any oil in fact. Because of difficulties in digestion the so-called predigested foods have come into notice, and I must say that most of them are things which are to be avoided. A firm in a western city attempted to do more than this; it concocted and advertised to physicians a *metabolized* cod liver oil, not only digested, but metabolized. Rightly interpreted this name signified more, probably, than the manufacturers intended. As ordinarily used the term metabolism refers to the sum of the changes through which a substance goes in passing through the body, and a metabolized fat is properly a completely oxidized product, a mixture of carbon dioxide and water, and therefore of no value as a food. On first examination of the product in question it was found to consist essentially of an alcoholic liquid with sherry wine flavor. Nothing of any value could be discovered in it. When the manufacturers were told of our findings they replied with much display of chemical learning that our analyses were faulty, we must look for *metabolized* oil. They were sure the product contained it, and a member of the firm with a chemist in their employ actually came in time to my laboratory to convince me that we must be wrong in our criticism. They returned home somewhat wiser, but not repentant. This is their scheme of metabolism: The oil was put in a tank with a large volume of lukewarm water, pepsin and hydrochloric acid to digest something, and sodium carbonate and minced or powdered pancreas to digest something else. The mixture was stirred up frequently and finally filtered, and to the filtrate enough wine was added to preserve it. All of the products of the metabolism were supposed to be in the filtrate, while the emulsion-like mass on the filter was thrown away! Notice the absurdity of the whole process. Pepsin and hydrochloric acid, pancreas extract and alkali, fat and water all in one mixture. What the pepsin and acid were supposed to accomplish I could not discover, but even without them the alkali and pancreas could alter or digest but little of the fat under the conditions. The fat was indeed left on the filter, practically all of it, and thrown away.

It seems like a waste of time to discuss such products, but remember they are sold to physicians, used by physicians and often praised by physicians as efficient remedies. The only way to discourage this scandalous

condition is to discover and publish the facts. Recently, and following our exposé of the metabolized oil, the manufacturers have had to face the authorities of the United States Department of Agriculture and have been fined heavily because of the same fraudulent advertising, in violation of the provisions of the Food and Drugs Act.

The next thing I wish to speak of is an "intercellular ferment." This name also sounds well, and it should impress the physician. This particular product is described as a hardy metabolic ferment, useful in tuberculosis, diabetes and various forms of malnutrition. In diabetes the organism gradually loses the power to oxidize or completely metabolize sugars, and these or certain derivatives may appear in large quantities in the urine. It has been a dream of physiologists and pharmacologists to produce a something which might, when taken as a remedy, overcome this difficulty and remove its cause. Many things have been tried. A few years ago Cohnheim thought he had discovered the missing thing in a combination of extracts from muscles and the pancreas, one of which was assumed to act as a catalyzer for the other. This mixture was believed to oxidize sugar rapidly and it was even proposed to make it on a large scale in a factory way in Germany. The American product, made by a New York firm, was claimed to do all the things required of this ideal ferment. It was advertised to contain an active enzyme which would pass through the stomach and intestines, the liver presumably also, and follow the blood stream to the remoter tissues where it would attack and oxidize the sugars with liberation of heat and mechanical energy. This would indeed be a wonder, even if it would not remove the cause of the trouble. The manufacturers seemed to confuse the two things, as is usually the case. But no proof was ever brought by the concern that it actually had such power, and on the face of it such a claim would appear doubtful. It is too much to assume that any enzyme could traverse so long a path and still remain active.

The substance came to us in the form of a light yellowish powder and in different samples was found to have little or no activity in any direction, or sometimes activity in the direction of converting sugar to lactic acid slowly. At one time a strong starch-converting power was claimed for it and also the power of rapidly digesting fats, but in our experiments these reactions were unworthy of notice. The powder was found to consist largely of a protein substance, apparently casein, and innumerable bacteria, some living, some dead, and resulted from an attempt to grow a certain fungus on a medium containing milk. What took place was this: a rapid development of lactic acid bacteria, with consequent coagulation of the milk, followed and the fungus-like mass which was skimmed off and dried contained, therefore, the casein and entangled bacteria with some molds and a few other growths. The sugar-converting power noticed was due primarily to the lactic bacteria present in vast numbers, and this explained the principal activity sometimes observed. The wonderful metabolic intercellular ferment was really a mass of bacteria and casein!

I know of few products which have been advertised in more high flown language than this so-called intercellular ferment. It was, besides, ethical, and the carefully coached detail men who recited its virtues to the medical profession were examples of good manners, correct dressing and remarkable acquaintance with physiological

terms. I should say physiological jargon, as the talks reeled off would not bear close inspection. It is no wonder that such men make an impression on the half educated doctor. Men are sometimes respected in proportion as they are not understood. I do not know who writes the scientific matter for some of these advertising firms. To the uninitiated it often sounds well, but to the physiologist or chemist the talk may be meaningless. Unfortunately, physicians can not all be sufficiently well trained to detect the frauds in all cases.

As an illustration of another kind of fraud consider the product known as X's Antiseptic Powder. X is a pharmacist of Washington and his manufactured remedies have much more than a local reputation. This powder was advertised as a "scientific combination of borate of sodium, alumen, carbolic acid, glycerin and the crystallized principles of thyme, eucalyptus, gaultheria and mentha," but on analysis we found it to contain boric acid 81.26 per cent., zinc sulphate 15.56 per cent. and a little water and flavoring matters. This was a petty swindle, but the worst of it was that the manufacturer, when confronted with the facts, attempted to excuse them with the statement that he had a right to use what he pleased and call the mixture by any name he chose in order to prevent imitations, as long as the product accomplished what he claimed for it. X claims to be strongly devoted to the ethical principle, and has recently published a little pamphlet in which he says much about honesty in business methods. It is fortunate that under the food and drug laws all such frauds may be punished. The label must be made to tell the truth.

I mention this case, which may appear a very unimportant one, because it illustrates an interesting point. It appears that at one time the X powder contained the substances, or some of them, as claimed on the label. Later a change or improvement was made, but it would be poor business policy to change the label. I am told that many business men reason the same way about manufactured articles and we have a good illustration in the antikamnia, spoken of above. This was an acetanilide mixture at the start, but now, to get around one of the provisions of the drug laws, it contains phenacetin instead, when sold in the United States, and acetanilide, it appears from the last analyses made, when sold in England. There is an element of danger in this practise. One may become accustomed to a certain large dose of the thing here and, thinking he has the same product, get a double dose of acetanilide if he buys it in England. The normal dose of the latter is about half that of phenacetin. Where are the "ethics" in such a practise?

As acetanilide has flourished under many aliases so hexamethyleneamine has appeared in a variety of forms. It has figured as urotropin, formin, cystogen, aminoform, hexamin, urotone and others. Uron is another preparation containing the same substance, and hails from St. Louis. The manufacturers give it the complex formula $LiC_{15}H_7N_4O_2$, but it appears to consist essentially of 58 per cent. of lithium benzoate and 42 per cent. of hexamethyleneamine.

Another firm advertises a remarkable salt under the name thialion, for which the chemical term sodio-tri-lithic-anhydrosulphate is given as a synonym. A beautiful graphic formula is added which reminds one of the first attempts of the freshman. The product actually contains sodium sulphate, sodium chloride, sodium citrate and a little lithium citrate. The journal in which this wonder has been extensively ad-

vertised is apparently owned by the medicine company, and is known as the *Uric Acid Monthly*. Ethics again!

All such things and many more are plainly frauds and easily disposed of but other articles come to us with which there is greater difficulty. One illustration may be given. Following the success of atoxyl, which is sodium arsanilate, a number of derivatives and imitations have appeared. Some of these are of the same general character, which may be established. But for other bodies containing arsenic and aromatic radicals the evidence is not as easily brought, and frequently considerable investigation is necessary to get at the facts. Unquestionably we shall now have a greater flood of aromatic arsenicals, since the discovery of the preparation known popularly as Ehrlich's 606 has called attention anew to the possibilities in this field. There will be many imitations and many things urged upon physicians as identical products. All such offerings will have to be investigated, and some of this work may possibly lie within the province of our council.

Our five years of effort are beginning to bring results. The better medical journals are becoming more careful in the admission of articles to their advertising columns, and a number are following closely the announcement of reports in the *Journal of the American Medical Association* and "New and Non-official Remedies" to the extent that they advertise no remedy which has not been approved by the council. Some of the newspapers of the country are dropping absolutely the advertising of medicines and medical appliances of all kinds, and there is now the certainty that this reform will spread.

We have reason to feel gratified by the success achieved, but a much greater work is ahead of us or some other body which may feel better able to take it up. It is not sufficient to establish the honesty of the claims made for a remedy or for its general behavior. More than this is necessary. The time is coming when some body of scientific men will be called upon to decide very definitely upon the accuracy and reasonableness of the therapeutic claims, and to draw a pretty sharp line between the good and the bad. To some extent this is being done now by our committee on therapeutics, but it was not so at the beginning, when we did not think it wise to attempt to decide questions of actual curative merit. At the start it was enough to secure a more rational tone in advertising with the elimination of all marked exaggerations; now the need of something more is seen and the council may attempt it. To fix actual therapeutic values is no easy task and to do it for all substances would more than tax the powers of the council, since much of the information desired can be obtained only by combined pharmacological and clinical study. Who can afford the time or energy for this? Sooner or later such work will have to be done by research institutions endowed for the purpose and the present work of our council may be taken as suggestive of the great need for effort in this direction.

There is a direction, however, in which the work of the council may be of importance in the immediate future, and in which the solution of the more elaborate problems hinted at may not be attempted. I spoke above of the "Pharmacopœia" and its revisions. A few months ago a committee was appointed to begin the regular decennial revision, the revision of 1910. As each ten-year period comes around the question of what should be dropped and what should be added comes up for discussion. This time the discussion promises to be a very animated one, as the more pro-

gressive of our physicians are calling for a thorough revision along lines suggested by the advances of modern chemistry, with the elimination of much of the old matter. On the other hand, certain things should be added from the newer remedies and the work of the council should give an insight into the value of some of these. A study of our work will show that by far the larger part of it is devoted to an examination of things which have, or claim to have, a fairly definite chemical composition, and this illustrates an extremely important point, viz., the gradual passing of an old system. The pharmacopœias of earlier times contained the descriptions of a large number of vegetable drugs and their aqueous or alcoholic extracts, and very naturally constancy or uniformity in composition was hard to secure. Extracts were made by percolating or otherwise treating a certain weight of the crude drug with a certain weight of the solvent, but there was no evidence to show that a tincture of aconite, for example, made from one lot of the root would contain the same amount of the active principle as a tincture made from the same weight of another and different lot of the drug. Before the day of chemical assays the same uncertainty obtained for all galenical preparations, and even yet is not entirely avoided. It must be remembered that crude drugs differ as do gold mines; some are rich and some are poor in the thing desired.

The tendency in recent years has been to replace the uncertain root or leaf or bark by a definite weight of the active principle present, the tinctures of cinchona, for example, by the proper weight of the alkaloids, and nux vomica by the pure strychnine. The preparation of new remedies becomes therefore largely a matter of chemistry, and in the end the chemist will be called upon to answer as to the probable value. I use the term "chemist" here in the broader sense, including the specially trained pharmacologist, and wish simply to emphasize my belief that in the pharmacopœias of the future the criterion of chemical purity must be much more rigidly enforced than in the past. The developments of organic chemistry have made this possible.

It is also probable that in the pharmacology of the future the study of the relation between intimate chemical structure and physiological action will play an increasingly important part. Pharmacology is indeed concerned largely with just such studies, and the prediction of action from the constitution is a not impossible advance. There is already the accumulation of a great deal of evidence bearing on the effect of introducing various substituting groups for hydrogen of aromatic radicals. Consider, for example, the different toxicities of the several hydroxybenzenes, the difference between benzoic acid and salicylic acid, the difference between acetanilide and phenacetin due to the presence of an ester group in the molecule of the latter. The possibilities in this direction are shown most emphatically in the remarkable series of artificial cocaine derivatives. Hundreds of these have been made, and among them we have bodies of considerable usefulness, the eucaines and stovaine, for example, along with many of no apparent value. With the great number known it should be now possible to discover by experiment the reasons for the activity in some cases, or the inertness in others. The question of therapeutic value should be worked out for all such substances and as knowledge advances it is hoped that the measure of value may be based on chemical properties and structure.

The revision of the "Pharmacopœia" from such a point of view would be an ideal work, but of course could not be consistently carried through at the present time. But a beginning may be made and in this the council may indirectly lend a hand. Our work is primarily for the good of medicine. The physician can not follow the highly specialized developments of physiological chemistry or pharmacology and he has the right to ask that the facts which he needs for use be put before him in sharp and unequivocal terms. In the past physicians have paid too little attention to the actual composition of the remedies they use, leaving this largely to the pharmacist. But in the newer developments in the use of curative agents they must have more of this exact knowledge, and there is no body better qualified than the American Medical Association to collect and classify this knowledge. The work of the association in the cause of medical education has been of enormous value, and the education of the physician in the field of rational therapeutics is but a natural and legitimate specialization of the general activity.

As already intimated it may not be practicable for a body organized as is the present Council on Pharmacy and Chemistry to proceed with a program as elaborate as the one just suggested. Possibly a new and permanent commission may have to undertake it and a natural outgrowth of the work of such a commission would be the gradual creation of a pharmacopœia suited to the actual needs of the American physician.

J. H. LONG

THE TWOFOLD FUNCTION OF THE UNIVERSITY[1]

THE ideal university, like the ideal state, is yet in the utopian stage. That a vigorous university is necessary to the life of a vigorous state is a principle or policy generally admitted and acted upon, not only by the European peoples wherever they are located, but also to an ever-increasing degree by those other races of mankind which have been brought under the immediate influence of the dominant civilization of the world. One can, however, still find communities, happily dwindling rapidly in number, on this American continent, where it is necessary to plead for the very existence of a real university. The need of such an institution is obscured by the fact of the community's parasitical dependence upon their more enterprising and far-seeing neighbors, from whom they get their supply of educated professional men.

Wherever the university is firmly established in the appreciative intelligence of the people it is conceived to have many functions. Such are seen in its relation to the state; its relation to the professor; its relation to the student; its relation to the discovery of truth; and its relation to the advancement of the civilization of the world.

The conception of the university as merely an intellectual restaurant to prepare in the most readily assimilable form a certain definite amount of mental food for a certain number of students every year is essentially an unworthy one. Yet I believe it is not an exaggeration to say that a large proportion of the higher institutions of learning in America (I use that word in its geographical sense) have regarded their duty as almost entirely performed when their students, having been lectured to with all possible diligence for several years, have been provided with

[1] An address delivered on September 28, 1910, at the University of North Dakota on the occasion of the inauguration of President Frank L. McVey, LL.D., and the celebration of the twenty-fifth anniversary of the founding of the university. Later this was given as the university address at the opening of the session of the University of Manitoba.

suitable parchments—written in an equally suitable dead language—certifying that they have remembered at least a certain specified minimum of what their teachers have told them.

No one would now advocate shutting the door of the university in the face of any student of whatever grade of ability, provided he is able to pass those reasonable standards imposed by the university to test his capability of profiting by the instruction provided therein. Yet it is nevertheless true that the capable student has a life-long grievance against the university if he is allowed to leave without a vision of the realms of assured knowledge, and some appreciation of the regions yet to be explored, which shall be to him an intellectual inspiration throughout the remainder of his days.

Various men, some at very great length, have given expression to what in their estimation constitutes a university. And on this occasion I wish to refer to two "ideas" of a university which have the great virtue of brevity, both of which are of American origin.

In establishing the great university which bears his name, Ezra Cornell set forth his ideal in these words: "I would found an institution where any person can find instruction in any subject." This statement contains several truths. It recognizes the universality of instruction requisite in a great modern institution; it implies that new branches of learning as they are organized must find suitable recognition in its courses of study; it ensures that no small aristocratic group of subjects, of ancient and honorable lineage, from their medieval dais shall look down with unregarded scorn upon a wider circle of newer, equally educative, and even more humanistic divisions of knowledge; it teaches implicitly that culture, that most distinguishing and characteristic charm of the truly educated man, is not a product of the study of a particular group of subjects.

It denies to no man the right of admission on account either of race or of religion. No chapter in the history of education affords more melancholy and lamentable reading than that recording the brutal policy of admitting to the university only those who were willing to subscribe to the particular religious belief or form of worship embraced by its controlling body. No responsibility surely can be more terrible than that of denying to any inquiring mind full and free access to the fountains of knowledge. But those dark days of bigotry and intolerance, and of a singular perversion of the spirit of religion, have so far receded that our indignation is now purely vicarious; and that once vital educational policy lies in the dust of history dead in deathless dishonor.

This ideal of Mr. Cornell, however, has one fatal demerit which renders it singularly unfit to be the confession of faith of a great university. As it reads it implies merely the dissemination of knowledge, not its creation; it invites the student to quench his intellectual thirst from placid glacial pools, not from living streams. Acting up to the fullest extent of the letter of this declaration would give but half a university, or rather not a university at all in the full and proper conception of that term. But, lest I should be misunderstood in my reference to Cornell University, an institution which I venerate as my alma mater in this country, let me hasten to add that that university from its inception has been under the administration of men possessed of those qualities of wisdom, ability and energy which have characterized the illustrious succession of distinguished American university presidents; and under their guidance that seat of learning has

developed so as to fulfil not only this ideal of the founder, but one far loftier and broader.

The second "idea" of a university to which I shall refer is contained in President Garfield's eulogistic remark concerning his old teacher and friend, that Mark Hopkins at one end of a log and a student at the other constitute a university. This epigrammatic statement, stripped of all superfluous words, vividly typifies the essential elements of a university, and implies their proper mutual relations.

On this occasion, the reference to this ideal is surely a happy one, inasmuch as Hopkins was not only teacher and investigator, but president as well; while the log is here represented by these splendid university buildings, two of which are now to be opened.

It is obvious that President Garfield's arrangement of the three elements of a university in order of importance was, Hopkins, student, log. In modern practise, however, this order is often reversed. While in some cases it may be difficult to decide whether the log or the student is first, Hopkins, as teacher, seems always to be last.

In order to have a university at all there must be administrators, teachers and students; there must also be buildings, properly located and equipped for the work that has to be done. An additional importance in this last respect attaches to the modern university in contrast with the ancient. Constant attention must be given to equipping those essentially modern science departments, if the institution is to give adequate instruction in the more recent extensions of natural knowledge. To an ever-increasing degree these contribute to the education of the modern scholar both through the importance of the facts themselves and the methods and spirit of investigation.

There is a grave danger, too, that the popular method of estimating importance by magnitude may here work almost irreparable harm. For if the people who provide the support for the institution see palatial buildings, richly equipped, and beautifully situated on a spacious campus, and if they see students consorting thither in hundreds and even in thousands, they may conclude in their enthusiasm that what they behold is surely a great university. Infected by the pride of the people, this feeling may be entertained by students and faculty alike. Yet it is not impossible for a university even under these favorable conditions to possess hardly a single element of real greatness.

There is now an expanding popular interest in the development of higher and technical education in America, and indeed throughout the world. Large gifts from men and women possessed of great wealth are yearly flowing to many of our institutions; and the people are emulating them by generously granting through their legislatures continually larger appropriations for all university purposes. Small buildings are replaced by larger, expensive equipments are ever added to, libraries are rapidly expanded, and gymnasiums lavishly supplied with all the paraphernalia deemed necessary for the highly specialized athletic activities of the modern student. No one will question the usefulness and importance of these aids in the development of the body, the mind and the character of the student. From the desire of greater ease and effectiveness in working, as well as from an appreciation of the stern necessities of the student, there are few professors but would submit to pecuniary and other sacrifices, as indeed they are submitting, in order that the material resources and greatness of their institutions may be increased. But I repeat, that as a people, or as peoples, we are in great

danger of having our judgment overwhelmed by the material part of the university, and lamentably fail to recognize that the university may not be accomplishing its larger purpose. No objection can be urged against these things in themselves, provided that a necessary and fundamental distinction is observed between such aids to intellectual development and intellectual development itself.

It must ever be kept in mind that the university has two great general functions: first, the creation; second, the dissemination of knowledge. I put the creation of knowledge first in importance, for, obviously, if the university had not originated and systematized knowledge, there would have been little to disseminate. Upon the second of these functions, the greater, but still not too great, stress has hitherto been laid in American universities. Yet we are not satisfied that we are getting the best results possible; or perhaps we can speak with certainty, and say we are satisfied that we are not getting the best possible results. For, as President Woodrow Wilson, of Princeton, is reported to have said:

> We must remember that information is not education. The greater part of the work that we are doing in our colleges to-day is to impart information.

However imperfectly it may perform its function, the university does serve its community by educating the youth of that community. But by virtue of its power of creating knowledge, the university benefits not only its own immediate constituency, but the world at large; for knowledge when published becomes available for the instruction of students wherever an institution of higher learning exists. By acting merely as an information bureau a teacher may instruct a hundred students; by discovering and elucidating a new truth the same teacher will instruct a hundred thousand. His power and influence, when investigation is added to teaching, are multiplied beyond measure. To make but a single reference: Had Sir J. J. Thomson confined himself to teaching mathematical physics he would have instructed a few score students: through the profound and brilliant researches which he has conducted and inspired, he is teaching in every university in the world. How immeasurably greater has been his influence, and that of his university, than it would have been had he chosen or been compelled to devote his life to teaching!

Civilization advances by the advancement of knowledge. Should investigation cease in every line of mental activity, the world would progress no further than it would be carried by the intellectual momentum which it has acquired through the wonderful and almost intoxicating increase of knowledge in the last century. Should investigation cease, should we not repeat the history of China? That intelligent people had at one time progressed far in knowledge, which must have been the result of a great mental activity. But from some cause or probably combination of causes, intellectual inquiry was stifled, with the result that for centuries China, self-satisfied, has been, if one may use such an expression, a living mummy, wrapped in the impeding cerements of a frigid pride in its past, a backward vision and strange forbidding customs.

In order that the necessary progress in extending the ever-widening boundaries of knowledge may be made in the best and most economical manner, some special class of men must adequately prepare themselves for this high duty, and "lay aside every weight that they may run with patience the race that is set before them." A divine impulse urges mankind to the in-

vestigation of the universe, with all diligence, and from all possible points of vantage. This will not be done at all except in fragmentary manner, unless some make it the business of their lives. No professional class of men is in a position to undertake this work except those who compose the faculties of our universities. If these will not do it, or are prevented from doing it, new agencies will be created for this special purpose, beyond the reach or control of the universities.

Professor William North Rice, of Wesleyan, has eloquently emphasized the importance of the faculty, more particularly perhaps from the teaching standpoint. But if true in reference to teaching, it is doubly true in reference to investigation. He said:

> When the old universities of Europe kindled anew the light of learning in the Dark Ages, it was the fame of great thinkers and great teachers that caused the ardent youth to throng by thousands to those centers of learning. Vast endowments and stately halls were a secondary development. And to-day the title of a college to the love of students and alumni and to the support of the public rests upon the intellectual activity, the high scholarship, the aptness to teach, the loyalty to truth and to all high ideals, of the members of the faculty. Secondary to these are stately buildings, rich museums, and even well furnished libraries and laboratories; and without these the college is dead—a body without the inspiring soul.

The university has always been the home of research. Throughout the middle ages men resorted thither that they might come in close contact with the great masters of learning. While at times faculties were timid in accepting or even positively hostile to new truth, yet it was from other faculties that the new truth emanated.

There are certain universities in the world whose names every educated man knows. Their fame has gone out through all the earth. With them we instinctively associate great names in science, philosophy, literature, and, indeed, great names in all intellectual realms. In these universities there seem always to have been great men; in them are great men to-day. From these fountains of learning there have issued in a never-ceasing stream, investigations, treatises and other multitudinous influences which have impressed the intellectual life of the world to an extent beyond all estimate. Why should this be true of some universities and not of all? Why should not all universities, at least those of larger income, occupy, as far as their age permits, equally honorable places in the records of the advancement of learning? Of how many universities can it be said that the fullest history of the mental achievements of the world might be written without the least occasion to mention their names? Every effect has its precedent cause; and either there are not enough great men born to supply all the universities, or else in some institutions there are not the right conditions to develop or to attract men of genius. A university is great and influential only as its faculty comprises great and influential men. With the development of scholars the environment has much to do. A faculty that either from choice or from necessity confines itself exclusively to teaching can not develop the beneficent characteristics of profound scholarship. Whatever may be its local influence, in the larger intellectual world it is comparatively impotent.

Examples of universities whose ideal is merely teaching, spring to my mind. I know several well where anything savoring of research is discouraged, privately and at times publicly, by some of those in authority, and their attitude has been approved by an equally short-sighted press. It seems often to be accepted as axiomatic that teaching and investigation can not both thrive together; whereas the reverse is more often true that the most inspiring

teaching and that most effective in the development of scholars is indissolubly joined to research. To magnify research is not to minimize teaching. The professor who can carry his pupils to the very confines of knowledge, and who even may venture to tell what may perhaps be hidden in those pathless regions beyond is himself "the pathfinder of those new lands" of knowledge. "The most painful defect in the American college at the present time," President Lowell is reported to have said, "is the lack of esteem for excellence in scholarship." How can we remove this reproach if we do not begin by esteeming scholarship at its source? What reality is there in our appreciation if we do not allow scholarship free and unrestrained development; nay, further, if we do not create such an environment in our universities that scholarship will naturally issue?

As a teacher in that division of knowledge, I have often wondered how much science we in America would have to teach to-day if all that was produced in Europe were eliminated. In how many branches of learning are the American universities merely disseminating the discoveries made by the professors in the universities of Europe? Should any one wish to learn how emphatically true this is in science let him read the impressive presidential address delivered by Professor E. L. Nichols before the American Association for the Advancement of Science at its Baltimore meeting. In one sense it matters nothing who discovers truth so long as it is discovered. Yet our feelings of patriotism will not allow us to content ourselves with that doctrine, nor is this desirable. Sentiment is a powerful stimulus to all our activities. Every patriot glories in the deeds of valor of his countrymen, and should likewise rejoice in their intellectual triumphs. In one of the sciences—astronomy—the long series of brilliant discoveries by American astronomers is such as to warrant a feeling of genuine pride and satisfaction on the part of every citizen of their country. What has been achieved in astronomy may also be accomplished in every branch of knowledge, provided the necessary conditions are observed; but not otherwise.

One respect in which many American professors work against their own ultimate interests, is the practise of publishing their investigations abroad, especially in Great Britain and in Germany. Such a course is the open and undisguised confession of a great superiority of the constituency of learning in foreign countries over that in America, a contrast which this procedure tends to perpetuate. As a British citizen I appreciate the delicate compliment to one of these countries. Nevertheless, it is a cause of never-failing surprise to me to observe a practise that appears to involve an injurious lack of national self-respect.

There are at least two ways in which the university can make itself fruitful in productive scholarship: one, by the establishment of a research school or faculty; the other, by giving every professor, who so desires, the opportunity and encouragement to investigate the unknown regions of his own particular branch of knowledge. Not only should the university afford the opportunity, but should expect it to be utilized by the faculty at large. As regards the former of these general policies, let me quote President Schurman, who has given this subject a great deal of attention.

> In the graduate department as in the university as a whole there is constant danger that the national tendency to worship mere magnitude may distort the vision of the faculty, and especially of the trustees and friends of the university. It is important, therefore, to keep clearly in view

the essential objects of a graduate school. These are the enlargement of existing knowledge and the training of young men and women of superior ability and education in methods of independent investigation so that they too may in time make some contribution to the stock of human knowledge. A love of knowledge, and an ardent desire to wrest something from the unknown, a conviction that science and scholarship are along with virtue the chief good of human life, would seem to be the animating motives of a life of research. Given this subjective equipment in combination with superior powers of observation, reasoning and imagination, and productive scholarship and science are assured. But these gifts are not possessed by all professors, and still less by all graduate students. . . . Similarly there should be a differentiation among professors of those who are qualified to engage in research and guide others in the same path, and those who are preeminent as teachers and assimilative scholars. Surely both are honorable careers, though different. That everybody is fit for everything is a fallacy dangerous enough in politics, but in education it is fatal and paralyzing.

The problem, therefore, which confronts the university in connection with the graduate school is to find the right sort of men for investigators whether as professors or students. And having found them it is the duty of the university to provide the necessary means for the prosecution of their work. This involves suitable salaries for professors, leisure for productive work, and the requisite apparatus and other instrumentalities for research.

A separately organized research faculty is by no means necessary, and possibly not the best agency, to accomplish the higher part of the duty of the university. Therefore, it is quite possible for any institution to participate in the toilsome delights of research. Where several enthusiastic men are associated in the same department, there ought to be that mutual interest, assistance and encouragement, so helpful in stimulating the spirit of investigation. Where but one man is in a department it is with much greater difficulty that a living active interest in research is maintained. If laboratory and library facilities are meager and the environment depressing, then interest wanes, action is deferred, and ambition dies a lingering and rebellious death, accompanied sometimes, too, by the death of the interest in teaching. These, it seems to me, are some of the chief and fundamental disadvantages under which smaller institutions labor.

In further elaboration of my argument let me quote from Professor Nichols's Baltimore address:

> But it will be found that the conditions for maximum scientific productiveness are precisely those which would exist in the ideal university. All attempts at a machine-made science are doomed to failure. Science-making syndicates are likely to meet ship-wreck on the very rocks on which our American educational system is already aground. No autocratic organization is favorable to the development of the scientific spirit. No institution after the commercial models of to-day is likely to be generously fertile. You can contract for a bridge, according to specifications. If a railway is to be built and operated a highly organized staff with superintendents and foremen and an elaborate system reaching every detail may be made to yield the desired results. No one, however, can draw up specifications for a scientific discovery. No one can contract to deliver it on a specified day for a specified price. No employee can be hired to produce it in return for wages received.

There is another aspect to this question. Whether in small or large institutions the professor has certain natural rights and privileges of which he can not justly be dispossessed. He is employed by the institution at a certain remuneration to perform certain stipulated duties; yet he can not be regarded merely as an employee of the university. He is not selling anything that belongs to the university; but he himself possesses that which the university sells. Without him the university has nothing to offer the student.

It has been asserted in extreme cases, that even the book that a professor might write is the property of his university. The arguments with which any one would

defend such an unprincipled doctrine would but succeed in proving him incapable of understanding the relation between university and professor, and in demonstrating his unworthiness to be associated in any capacity with an institution of learning. The professor has surely inherent rights of which the university can not properly deprive him by institutionalizing him for teaching purposes, and the greatest of these to my mind is the right to engage in the investigation of truth.

In some universities there are now being established research chairs. While much can be said in favor of such endowments, some objections can be raised. Far be it from me to deprecate the giving of a large salary to any professor! But what reason is there for attaching relatively lavish remuneration to any position simply because it is called a research chair? Truly the recognition of research is gratifying; but surely the same reasons can be urged why all who so desire it should be research professors. If abundant means are available for the establishment of more chairs in a department, the desired result will be more certainly attained if all professors, old as well as new, are given larger salaries and the same privileges. Moreover, if some chairs are specifically research, others will be looked upon, perhaps looked down upon, as non-research or teaching, with possibly a lowering of the estimation in which teaching is held—a condition as regrettable as it is unnecessary. Further, it is a policy of very doubtful wisdom to permit any professor to become practically inaccessible to students; and the more illustrious the professor, the greater is the folly of such a course. A large part of the duty of professors engaged in research must ever be to train and inspire other men for similar pursuits.

President Schurman quotes the late Lord Kelvin, as saying "that the ideal arrangement for the investigator is to combine research with teaching, but with the amount of teaching reduced sufficiently to leave leisure and vigor of faculty for research." To quote further:

> The biographer of Pasteur records that that eminent scientist entertained similar sentiments. "Pasteur did not suggest that a scientist should give up teaching; he recognized on the contrary that public teaching forces him to embrace in succession every branch of the science he teaches. But let him not give too frequent or too varied lectures! They paralyze the faculties," he said, being well aware of the cost of preparing classes.

Of the conditions that make for success in research, no one could speak more authoritatively than Helmholtz. In a celebrated address given near the close of his long and richly fruitful life, he said:

> There are many narrow-minded people who admire themselves enormously if they have one stroke of luck, or think that they have had one. A pioneer in science or an artist, who has a repeated run of happy accidents, is indubitably a privileged character, and is recognized as a benefactor of mankind. But who can count or weigh such lightning flashes of the mind? Who can trace out the secret threads by which our conceptions are united? . . . I must confess that the departments in which one has not to trust to lucky accidents and inspirations have always had the greatest attraction for me. Yet as I have often been in the predicament of having to wait on inspiration, I have had some few experiences as to when it came to me, which may perhaps be of use to others. Often enough it steals quietly into one's thoughts and at first one does not appreciate its significance; it is only sometimes that another fortuitous circumstance helps one to recognize when, and under what conditions, it occurred to one; otherwise it is there, one knows not whence. In other cases it comes quite suddenly, without effort, like a flash of thought. So far as my experience goes it never comes to a wearied brain, or at the writing table. I must first have turned my problem over and over in all directions, till I can see its twists and windings in my mind's eye, and run through it freely, without writing it down; and it is never possible to

get to this point without a long period of preliminary work. And then, when the consequent fatigue has been recovered from, there must be an hour of perfect bodily recuperation and peaceful comfort, before the kindly inspiration rewards one. . . . It came most readily, as I experienced at Heidelberg, when I went out to climb the wooded hills in sunny weather. The least trace of alcohol, however, sufficed to banish it. Such moments of fertile thought were truly gratifying, but the obverse was less pleasant when the inspiration would not come.

That Helmholtz did not believe in a divorce of teaching from investigation is evident from another quotation from his biography:

Nor did he regard the university lectures simply as an obligation laid upon him by the state, which provided him with sustenance, with scientific instruments and with a goodly proportion of spare time, and therewith had the right to claim from him that whatever he discovered by this aid should be freely communicated to his students and his fellow citizens; he always appreciated the fact that lecturing compelled him to test each isolated proposition strictly, to formulate each conclusion correctly, and, since he could only assume a limited amount of previous knowledge in his hearers, to state the evidence for the views he was maintaining in as simple a manner as possible.

It is evident that research requires a considerable amount of time, free from teaching and other work of a routine character. What would have been the state of science to-day had Newton been obliged to teach many hours per week for nine months in the year? How much of that profound and necessary abstraction of mind could he have cultivated under the conditions which circumscribe the professors in our universities? The history of research proves that truth is purchased at a heavy price; if we will not consent to pay that price we shall have no share in its discovery. Truth might well say: "Ye shall seek me, and shall find me, when ye shall search for me with all your heart."

Another way in which much time and energy of the faculty is consumed is in excessively frequent examinations. This is the secondary school method carried into a place whence its usefulness has departed. It has its origin in a species of paternalism which in the university often defeats the very end it was designed to serve. Examples of university departments occur to me where fortnightly or other examinations were indulged in *ad libitum*, and, I may say, *ad nauseam*, with no conspicuously good results. When in addition, as is sometimes the case, there is added exemption from a final comprehensive examination of high and rigorous standard, positive harm results to the student, who, however, is not easily persuaded that he has been thereby deprived of an educational blessing.

For stimulating and inspiring the professor in the exercise of his function as an investigator, there exist other exceedingly valuable agencies, which, though not a part of the university nor under its control, can be and should be morally supported by the university. These are the societies and associations formed for the advancement of knowledge. Cardinal Newman has set forth the value of such meetings as those of the British Association for the Advancement of Science in his discussion of "What is a University" (written in 1854), from which I venture to quote:

As regards the world of science, we find a remarkable instance of the principle which I am illustrating, in the periodical meetings for its advance, which have arisen in the course of the last twenty years, such as the British Association. Such gatherings would to many persons appear at first sight simply preposterous. Above all subjects of study, science is conveyed, is propagated, by books, or by private teaching. Experiments and investigations are conducted in silence; discoveries are made in solitude. What have philosophers to do with festive celebrities, and panegyrical solemnities with mathematical and phys-

ical truth? Yet upon a closer attention to the subject, it is found that not even scientific thought can dispense with the suggestions, the instruction, the stimulus, the sympathy, the intercourse with mankind on a large scale which such meetings secure. . . . The novelty of place and circumstance, the excitement of strange, or the refreshment of well-known faces, the majesty of rank or of genius, the amiable charities of men pleased both with themselves and with each other; the elevated spirits, the circulation of thought, the curiosity; the morning sections, the outdoor exercise, the well-furnished, well-earned board, the not ungraceful hilarity, the evening circle; the brilliant lecture, the discussions or collisions or guesses of great men one with another, the narratives of scientific processes, of hopes, disappointments, conflicts and successes, the splendid eulogistic orations; these and the like constituents of the annual celebration are considered to do something real and substantial for the advance of knowledge which can be done in no other way. . . . They issue in the promotion of a certain living and, as it were, bodily communication of knowledge from one to another, of a general interchange of ideas, and a comparison and adjustment of science with science, of enlargement of mind, intellectual and social, of an ardent love of the particular study, which may be chosen by each individual, and a noble devotion to its interests.

Lastly, scholarship can not thrive except in an atmosphere of freedom of thought, of speech and of action. No restraint should be laid upon the professor, nor indeed should any be necessary, other than that an educated gentleman necessarily lays upon himself.

The Declaration of Independence of the United States recognizes as one of the rights of man the privilege of the pursuit of happiness, though philosophers tell us that that pursuit can never be crowned with complete success. Happiness is a by-product, as it were, of devotion to duty. Similarly, if the highest educational interests of the students are desired, and if the university is most completely to serve the state, these issues will best come not by directly seeking them, but as a certain result of promoting in a large and generous measure the interests of the faculty.

How mightily influential for good is the president of the university, whose high privilege it is, not only to be a master in his own special department, but to work in or through all departments of the institution's activities! All the conspicuously great American and Canadian presidents have themselves been eminent in their own fields as investigators and teachers; but they have also exercised a stimulating influence upon all other members of the faculty. Many of the greatest of these, notably the late President Harper, of Chicago, remained a teacher to the end, and refused to allow himself to be absorbed wholly by administrative duties. As a consequence, the new university over which he presided very speedily took its place as a seat of higher learning by the side of other institutions with histories going back to the previous century.

The president more than any one else can act as a powerful force in developing public opinion to recognize the high functions of a university, and in winning the support of those to whom the university must look for maintenance, and can enlist their sympathy in the intellectual task of the discovery and dissemination of truth, which is the twofold function of a university in the world's work.

Perhaps the most impressive feature of the nineteenth century was the remarkable development of the United States as a nation. A vast and empty territory has been filled with a strong and vigorous people; there have been great political upheavals and industrial movements; colossal commercial enterprises have been conceived and executed, from which fabulous private and corporate wealth has been accumulated. Yet among them all there is nothing more impressive and significant than the

universal spread of popular education, the only secure foundation upon which democracy can rest. A great feature of this movement has been the establishment of the state universities, whose evolution has been so rapid as to appear not gradual, but *per saltum;* in some cases they seem to have sprung forth fully armed, like Minerva from the head of Jove.

In some of the provinces of my own country we are paying you the sincere compliment of imitation. We have therefore a direct interest in hoping that you will place your institutions upon the broadest possible basis. By constantly turning the searchlight of an educational higher criticism upon the methods and subjects of instruction, what is relatively useless will gradually be eliminated, and what is useful will be preserved and strengthened. Signs are not wanting that the universities are realizing that their functions have not all been exercised, that the greater part of their power for investigation has been a talent uselessly hidden in the earth.

The unexampled annals of the discoveries of truth of the nineteenth century are written, and they chronicle largely the magnificent achievements of the universities of Europe. The century upon which we have entered, which has already witnessed profound extensions of knowledge, will be yet more remarkable, and in it shall not the American universities play an equally triumphant part? And when its record of mental conquests shall be completed, among those inscribed therein, I trust that this university, whose semi-jubilee we celebrate, and whose president is now being inaugurated, will have its name written in that book of intellectual life.

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A COMPARISON BETWEEN FRATERNITY AND NON-FRATERNITY EXPENSES AT THE UNIVERSITY OF ILLINOIS

MUCH has been said and written recently, about the justification for the existence of the fraternity in the college and university, and, from all indications, the investigations are merely begun.

The purpose of this article is to set forth the results of a personal investigation into and comparison of the total expenses of about three hundred fraternity men and a like number of non-fraternity men at the University of Illinois. A member of each of the twenty-three fraternities was asked to canvass his respective fraternity and secure from each eligible member the total amount of his expenses during the nine months of the preceding school year or 1908–9. If the man had no accurate account of his entire expenses he was asked to make as close an estimate as possible. The answers were obtained from the non-fraternity men by a personal canvass by three students among them either on the campus or at their rooms. For sake of accuracy of figures, those men were avoided who were working a considerable portion of their way. The figures and a graphical picture of the data are shown.

Attention is called to the fact that the two curves are very similar, and with the exception of the extremely high values for the fraternity expenses, the corresponding points of the two curves differ on the average by $150, which seems to show that the average fraternity man at Illinois spends about $150 more than the average non-fraternity man.

The 284 fraternity men spent $166,725, or an average of $587.06, while the non-fraternity men spent $115,348.25, or an average of $407.56. The modes of the curves show that the largest single group of fraternity men spent between $500 and $550, and that the largest group of the non-fraternity men spent between $400 and $450. Only three non-fraternity men were found who spent $700 or more. Sixty-nine fraternity men spent $700 or more. Forty-four fraternity men spent $750 or more, while fourteen went to the $1,000

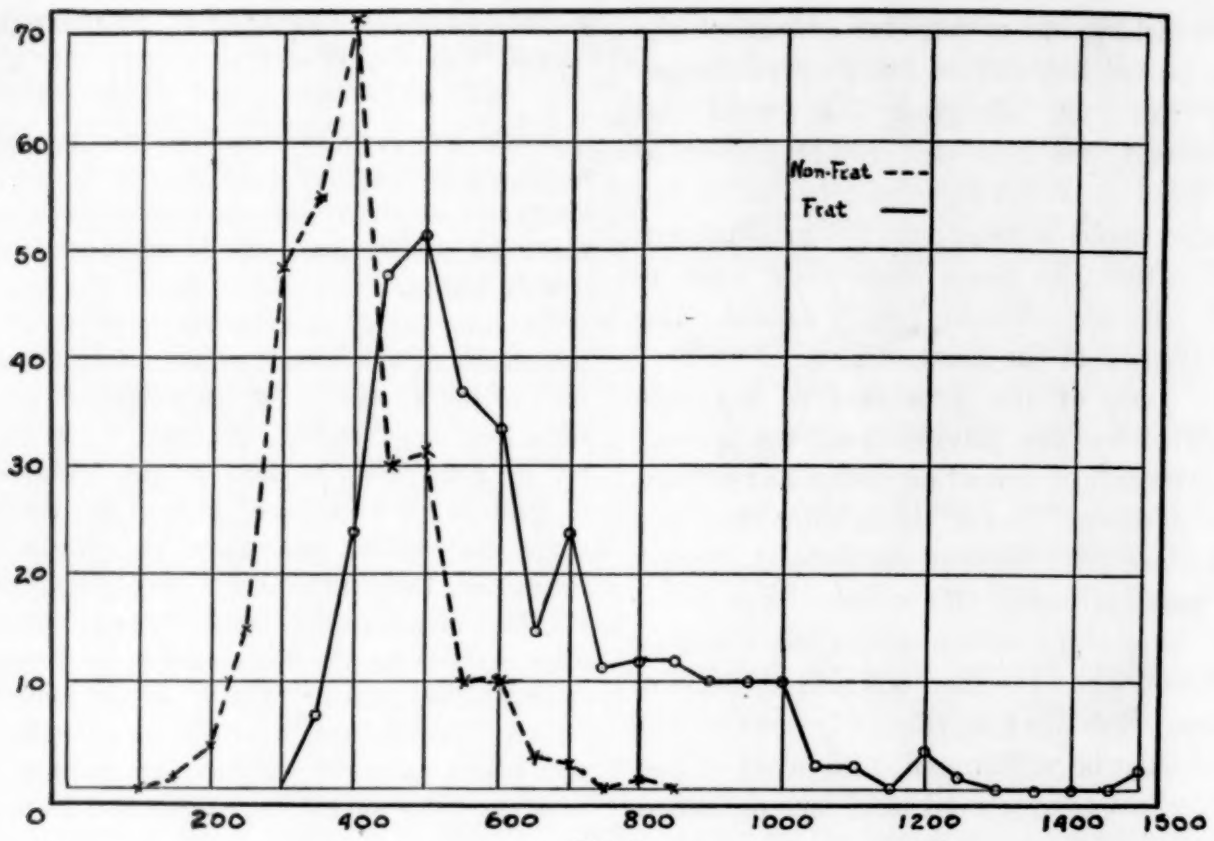

FIG 1

	Fraternity	Non-fraternity
1500–1549	1	
1450–1499		
1400–1449		
1350–1399		
1300–1349		
1250–1299	1	
1200–1249	3	
1150–1199		
1100–1149	2	
1050–1099	2	
1000–1049	5	
950– 999	5	
900– 949	5	
850– 899	7	
800– 849	7	1
750– 799	6	
700– 749	24	2
650– 699	15	3
600– 649	34	11
550– 599	37	10
500– 549	52	32
450– 499	48	30
400– 449	24	71
350– 399	6	55
300– 349		49
250– 299		15
200– 249		4
150– 199		1
	284	284

mark or above. It was surprising to find so many fraternity men keeping a systematic expense account; in fact, more than half were able to give a fairly definite account of their expenses. There might be several reasons for this; so many fraternity men have a certain allowance from home and are compelled to give a fairly strict account of their expenditures. Others do it for their own information and, no doubt, the rest are influenced by these.

The 284 fraternity men represent practically all the eligible material, for since the statistics are based on expenses incurred the preceding year, only those freshmen, sophomores and juniors who returned are eligible, the freshmen and new men of the current year being ineligible.

Concerning the fraternity data themselves, as a general thing, those fraternities which are national and reputably strong spent the most,

while the men of the local organizations incurred no more expense on the average than the non-fraternity men. One strong fraternity had thirty eligible men, of which half spent $800 or more, while seven spent $1,000 or more. One local organization had no man spending more than $600. Four had no man spending more than $650 and eleven had no one exceed $750, while practically all had men spending as low as $400 or $450.

What shall be our conclusions? If our figures are assumed to be perfectly representative, which they should be as far as comparisons are concerned, how much criticism is due the fraternal organizations?

We must not overlook the fact that the fraternity man is at an expense simply for membership in the organization, such as initiation fees, dues, assessments, social fees, etc., which we may set at $50 for the average, many going far above that figure and many below it. This leaves $100 per man to be accounted for. It is an open question as to whether this extra expense represents extravagance or not. Remembering that in all statistics results must be weighed and reweighed lest ridiculous conclusions be made, we must not overlook one point lest we suffer the same penalty. A large portion of the fraternity men who are extravagant would be so, even if they were not members of such an organization, and if this is true to the extent that it accounts, or more than accounts, for the extra $100 per man, then the fraternity itself can not be blamed and may even be considered a real benefactor in this respect. Some insist that in many cases such extravagance is reduced by association with more thrifty brothers. There is very strong argument in favor of the declaration that this $100 is more than accounted for, for the reason that a fraternity man does not care to spend his time where he would likely spend a lot of money, as much as he would if he were outside, because of his congenial companions and home in the fraternity house. But as I said before, this is an open question and will be decided in a multitude of ways.

But I do think the fraternity deserves a great deal of criticism wherever it allows the extremely extravagant cases to exist. If we examine the curves, we shall notice nothing about the non-fraternity curve which corresponds to that part of the fraternity curve for the expenditures above $1,000, although the two curves correspond at other points rather extraordinarily.

C. H. FORSYTH

UNIVERSITY OF ILLINOIS

MR. CARNEGIE'S TRUST FUND FOR PROMOTING PEACE

As has been announced in the daily papers Mr. Andrew Carnegie has given $10,000,000 of the first mortgage bonds of the U. S. Steel Corporation of the value of $11,500,000, the income to be used to hasten the abolition of international war. In his letter of gift, Mr. Carnegie says:

Lines of future action can not be wisely laid down. Many have to be tried, and having full confidence in my trustees I leave to them the widest discretion as to the measures and policy they shall from time to time adopt, only premising that the one end they shall keep unceasingly in view until it is attained is the speedy abolition of international war between so-called civilized nations.

When civilized nations enter into such treaties as named, or war is discarded as disgraceful to civilized men, as personal war (duelling) and man selling and buying (slavery) have been discarded within the wide boundaries of our English-speaking race, the trustees will please then consider what is the next most degrading remaining evil or evils whose banishment—or what new elevating element or elements if introduced or fostered, or both combined—would most advance the progress, elevation, and happiness of man, and so on from century to century without end, my trustees of each age shall determine how they can best aid man in the upward march to higher and higher stages of developments unceasingly, for now we know that as a law of his being man was created with the desire and capacity for improvement to which, perchance, there may be no limit short of perfection, even here in this life upon earth.

Let my trustees, therefore, ask themselves from time to time, from age to age, how they can best help man in his glorious ascent onward and upward, and to this end devote this fund.

Senator Elihu Root has been made chairman of the board of trustees, the other members of which are as follows:

Dr. Nicholas Murray Butler, president of Columbia University; Dr. Henry S. Pritchett, president of the Carnegie Foundation for the Advancement of Teaching; Joseph H. Choate, lawyer, ex-ambassador to Great Britain; Albert K. Smiley, Lake Mohonk, educator and humanitarian; Charles W. Eliot, president emeritus of Harvard University; James Brown Scott, solicitor of the State Department; John W. Foster, lawyer, ex-Secretary of State; Andrew J. Montague, lawyer, ex-governor of Virginia; William M. Howard, lawyer, congressman, Lexington, Ga.; Judge Thomas Burke, Seattle, Wash.; James L. Slayden, congressman, San Antonio, Tex.; Andrew D. White, ex-Ambassador to Germany; Robert S. Brookins, lawyer, St. Louis; Samuel Mather, banker, steel manufacturer, Cleveland; J. G. Schmidlapp, railroad man, Cincinnati; Arthur William Foster, regent University of California, San Francisco; R. A. Franks, banker, Hoboken, N. J.; Charlemagne Tower, ex-ambassador to Germany and Russia; Oscar S. Straus, ambassador to Turkey; Austen G. Fox, lawyer, New York; John L. Cadwalader, lawyer, New York; John Sharp Williams, senator-elect from Mississippi; C. L. Taylor, of Pittsburgh, chairman of the Carnegie Hero Commission; George W. Perkins, of New York, financier and philanthropist; Robert S. Woodward, of Washington, and Cleveland H. Dodge, of New York, the president and secretary, respectively, of the Carnegie Institution of Washington.

SCIENTIFIC NOTES AND NEWS

The American Association for the Advancement of Science holds its opening meeting at Minneapolis on the evening of Tuesday, December 27, at eight o'clock, when the retiring president, Dr. David Starr Jordan will give his address which is entitled "The Making of a Darwin." A list of the societies meeting at Minneapolis in affiliation with the association and of the societies meeting at Ithaca, New Haven, Pittsburgh, Providence and New York, is given elsewhere in this issue.

The Royal Belgian Academy of Arts and Sciences has awarded the Charles Lagrange Prize of 1,200 francs to Dr. L. A. Bauer, director of the department of terrestrial magnetism of the Carnegie Institution of Washington. This prize is awarded for the best printed or unprinted treatise which shall form a contribution of material value in geophysics. The prize was awarded on Dr. Bauer's publication, "The United States Magnetic Tables and Magnetic Charts for 1905" and for his general contributions to terrestrial magnetism.

Dr. Alexander Graham Bell has been elected an honorary member of the Royal Institution, London.

Professor J. C. Kapteyn, of Groningen, Holland, has been elected an honorary fellow of the Royal Society of Edinburgh.

Professor Raphael Meldola, F.R.S., professor of chemistry in Finsbury Technical College, London, has received the doctorate of science from Oxford University.

Captain R. E. Peary has deposited in the U. S. National Museum the series of sixteen gold and two silver medals that have been awarded to him. They include the great gold medal of the National Geographic Society of Washington, presented to him for his "discovery of the North Pole," and the great gold medal of the Royal Geographical Society of London, designed by Mrs. Scott, wife of the leader of the British South Polar Expeditions and presented to Captain Peary for "Arctic Exploration, 1896–1909."

Dr. George Bruce Halsted has been elected corresponding member of the Société des Sciences physiques et naturelles, Bordeaux, in whose *Mémoires* appeared his "La contribution non euclidienne à la philosophie."

Mr. Walter Campbell Smith, of Corpus Christi College, Cambridge, has been appointed to an assistantship in the mineralogical department of the British Museum.

The Japanese Antarctic expedition, under Lieutenant Shirase, started on November 28 from Shinagawa Bay aboard the 150-ton schooner *Kainan Maru*.

Professor Josiah Royce, of Harvard University, has accepted the invitation of the trustees of Lake Forest University to deliver

the next course of Bross lectures at Lake Forest, Illinois, in November, 1911.

DR. A. A. MICHELSON, of the University of Chicago, delivered the seventh lecture upon the J. C. Campbell Foundation of the Sigma Xi Society of the Ohio State University on the evening of December 2. His subject was "Metallic Colors in Birds and Insects." The lecture was amply illustrated by lantern and reflectoscope and was concluded by an explanation of the most probable cause as found by the lecturer as a result of his researches. Professor L. H. Bailey, director of the New York State School of Agriculture of Cornell University, will lecture on "The Country Life Movement" upon the Campbell Foundation on February 8.

WE regret to record the following deaths: Dr. Rudolf Fittig, emeritus professor of chemistry at Strasburg, at the age of seventy-five years; Dr. Stanislaus von Kostanecki, professor of organic chemistry at Berne, at the age of fifty years; Dr. Felix B. Ahrens, associate professor of agricultural chemistry at Breslau, at the age of forty-seven years, and Dr. Alexander Schenk, docent for anthropology at Lausanne, at the age of thirty-six years.

REDUCED rates on the "certificate plan" of one and three fifths fare for the round trip have been granted by the Trunk Line Passenger Association and the New England Passenger Association for the meetings of the Geological Society of America, the Paleontological Society and the Association of American Geographers in Pittsburgh, December 26–31.

THE annual meeting of the council of the American Federation of Teachers of the Mathematical and the Natural Sciences will be held at the University of Minnesota, Minneapolis, on Wednesday and Thursday mornings, December 28–29 at 10 A.M. At the meeting on Wednesday, reports will be presented from the executive committee, the various local associations and the committees on bibliography, on logarithmic tables, on the chemistry unit, on a syllabus in geometry and on a mathematical journal. Any business that should come before the council will be presented, and an opportunity will be given for the introduction of new business. The meeting on Thursday morning will be a joint session with Section L of the American Association for the Advancement of Science. At this meeting the report of the committee on the relations between the college and the secondary school will be presented and discussed, and Professor E. L. Thorndike, of Columbia University, will present a paper on methods of testing the efficiency of science and mathematics teaching.

MR. ANDREW CARNEGIE has agreed to give to the Maria Mitchell Memorial Association a sum of $10,000 toward the establishment of a research fellowship in astronomy, on condition that the sum of $5,000 required to complete the fund of $25,000 be subscribed.

THE Naples Table Association for promoting Laboratory Research by Women calls attention to the fact that the year of the association begins in April and all applications for the year 1911–12 should be sent to the secretary on or before March 1, 1911. A prize of $1,000 has been offered periodically by the association for the best thesis written by a woman, on a scientific subject, embodying new observations and new conclusions based on an independent laboratory research in biological, chemical or physical science. The fourth prize will be awarded in April, 1911. Application blanks, information in regard to the advantages at Naples for research and collection of material and circulars giving the conditions of the award of the prize will be furnished by the secretary, Ada Wing Mead (Mrs. A. D.), 283 Wayland Ave., Providence, R. I.

MR. ALTON, of the English Radium Institute, has bought from the Austrian ministry of works, on behalf of Sir Ernest Cassel, one gram of radium for the sum of $75,000. The radium is a gift by Sir Ernest Cassel to the institute and is intended for use in cancer research.

THE United States steamer *Fish Hawk*, of the Bureau of Fisheries, is at present engaged

in a survey of the public oyster grounds of Mobile Bay and Mississippi Sound. This work, undertaken by the division of scientific inquiry, is under the immediate charge of Dr. H. F. Moore, assisted by Mr. T. E. B. Pope, assistants of the Bureau of Fisheries. The survey has for its object the accurate charting of all areas of oyster growth, detailed examinations of such growth respecting quality, quantity and conditions of oysters located, and the determination of suitable but unutilized ground.

According to information printed in the *Geographical Journal,* the Austrian African traveler, Herr Otto Artbauer, set out in October with the intention of making his way into the Tibesti region between Fezzan and Wadai—the portion of Africa which best deserves the epithet "dark" in our own day. He is accompanied by an Austrian artillery officer, First Lieutenant Emil Kraft von Helmhacker. The leader is an Arabic scholar and is also master of a number of African dialects, besides possessing ethnographical and geological qualifications. His companion will undertake the cartographical work and meteorological observations. As is well known, the relatively fertile highlands of Tibesti are inhabited by the Tibbu—a race known to the ancient Romans—who have an evil reputation for wildness and barbarity. Nachtigal has been, so far, the only traveler who has come into contact with them and escaped with his life, though the opinion has been expressed, both by Slatin Pasha and by Oskar Lenz, that their country might be safely crossed by a traveler who could convince them of his peaceable intentions. The new expedition is well equipped, and provided on the one hand with presents likely to be held in esteem in that region, and on the other with serviceable weapons. After completing their proposed examination of Tibesti, the travelers hope to cross Wadai by a route leading well east of Lake Chad, though should the state of affairs in that country make this impossible, they will take the easier way towards the Kamerun.

UNIVERSITY AND EDUCATIONAL NEWS

The progress thus far made in ascertaining the approximate value of the Wyman bequest for the Graduate College of Princeton University confirms the original estimate of between $2,000,000 and $3,000,000. Erection of the buildings will be started in the spring, and will include, in a large quadrangle, the Thomson Graduate College, the Cleveland Memorial Tower and the Proctor Memorial Dining Hall. The faculty committee on the graduate school has been reconstituted with one member from each of the eleven departments of the university, as follows: Dean Andrew F. West, chairman; department of philosophy, Professor John G. Hibben; history, politics and economics, Dean Edward Elliott; art and archeology, Professor Allan Marquand; classics, Professor Frank Frost Abbott; modern languages, Professor W. U. Vreeland; English, Professor T. M. Parrott; mathematics, Professor L. P. Eisenhart; physics, Professor W. F. Magie; chemistry, Professor Fred Neher; geology, Professor W. B. Scott; biology, Professor E. G. Conklin.

As a memorial to her husband, Mrs. Edward H. Harriman, of New York City, has endowed with $100,000 the chair in forest management in the Yale Forest School.

The foundation for the new $50,000 science hall of Dakota Wesleyan University has been completed and work on the superstructure will be advanced as rapidly as weather conditions will permit. This building will consist of two stories and basement and will contain laboratories for physics, chemistry and biology besides class rooms and a large lecture room.

The Massachusetts Institute of Technology will hold a Congress of Technology on April 10 and 11 next to celebrate the fiftieth anniversary of its establishment.

The Oxford congregation has rejected the plan to make Greek optional in the entrance examinations by a vote of 188 to 152.

A despatch from Munich says that the oath disavowing modernism, required of theological professors by the Vatican, has caused a schism in the faculty at the University of

Munich. One professor has retired from the church.

DR. GEORGE EDGAR VINCENT, professor of sociology and dean of the faculties of arts, literature and science in the University of Chicago, has been appointed president of the University of Minnesota.

BARTHOLOMEW J. SPENCE, Ph.D. (Princeton, 1909), has been made assistant professor of physics in the University of North Dakota, and Edward B. Stephenson, Ph.D. (Illinois, 1910), instructor in physics in the same institution. Dr. Spence was assistant in physics at Wisconsin 1905–06; instructor at Illinois 1906–07, and instructor at Princeton 1909–10. He has had several years of teaching experience in the high schools of Illinois and in Knox Academy. Other appointments at North Dakota are E. C. Griess, E.E. (Purdue), as instructor in mechanical drawing, and William E. Henwood (Armour Institute, 1910), instructor in mechanical engineering. William T. Wells, M.D. (Ann Arbor), has accepted a position in the Public Health Laboratory, and Robert P. Stark, M.D. (Ann Arbor), and Carl F. Raver, M.D. (Ann Arbor), in the branch laboratories, located, respectively, at Minot and Bismarck.

DR. ALBERT EINSTEIN, professor of physics at Zurich, has been called to the chair of mathematics and physics in the University of Prague.

DISCUSSION AND CORRESPONDENCE

CALENDAR REFORM

TO THE EDITOR OF SCIENCE: In Professor Chamberlin's discussion on "The Reform of the Calendar," in SCIENCE of November 25, 1910, after reference to discussions on the subject by Reininghaus, Slocum, Cotsworth, Patterson and Dabney, the suggestion is made that 364 days be divided into four quarters, each to consist of three months of four weeks each and a "close week," to be called: (1) Easter Week between March and April, (2) Julian Week between June and July, (3) Gregorian Week between September and October and (4) Christmas Week between December and January, these *close weeks* to be named and known in addition to the twelve months; and the odd days (365th every year, and 366th in every fourth year), which are to be placed between Christmas Week and January, are to belong to no month or week, are not to be named as days of the week, but only as New Year's Day and Leap Day, respectively, but they are to be counted with the days of the old year. Thus every year, every month, and every week is to begin with the same day of the week, this day to be Monday.

Professor Chamberlin advises that sufficient study should be given to this subject from all points of view, so that the new calendar may be "so well matured before its adoption is seriously urged that it will not itself need to be laid aside for something better by the time it has fairly come into use."

In accordance with this advice I beg to point out some objections to the calendar proposed and to suggest a calendar which includes the advantages and eliminates the objections.

To omit certain weeks from the designated months and to omit certain days from both the recognized weeks and the named months are serious objections, as would be similar omissions in the division of any whole into its parts. To change the first day of the week from Sunday to Monday adds confusion without any apparent benefit. To introduce four names (for the *close weeks*) in addition to the twelve names of months is less objectionable, but to eliminate a day, or two days, from the weekly measure of days is the point of paramount objection; and I predict that no calendar which requires such elimination will ever be accepted, primarily because of the law recognized for four thousand years, which reads:

> Remember the Sabbath Day to keep it holy.
> Six days [not seven or eight] shalt thou labor, and do all thy work:
> But the seventh day [not the eighth, nor even the seventh and eighth] is the sabbath of the Lord thy God; in it thou shalt not do any work.

Will Jews and Christians set aside this law for one week each year?

The calendar I would suggest puts four weeks of seven days each in eight months, and five weeks of seven days in March, June, September and December. Every fifth year a leap week is added to December, except that the last leap week is omitted each forty years, save the tenth; and each 20,000 years, save the tenth—time periods being reckoned since Christ. Thus there would be no leap week in 1960, 2040, 2080, etc., but there would be in 2000, 2400, 2800, etc., and again there would be no leap week in 20,000, 40,000, 60,000, etc., but there would be in 200,000, 400,000, 600,000, etc.

This provides for exactly the same number of days in a four-hundred-year period as the current calendar, and it makes a necessary correction beyond the four-hundred-year periods not provided for in the Gregorian calendar, thus reducing the error in the average length of the year from 26 seconds to less than 1 second.

Even the present calendar must be corrected daily for any exact measurements or computations; while, with the great meteorological variations in seasons, the adjustment proposed for the five- and forty-year periods could not be detected in single-year weather records and would be quite as acceptable as present adjustments for the four-year and century periods.

We are already accustomed to months with the number of days varying from 28 to 31. Indeed, probably half the people look to the wall calendar to learn how many days the month contains; and to date a letter "September 35" or even "December 42" (once in five years) would be systematic and simple in comparison with "Gregorian Week 7" or "New Year's Day, 1911," when that is to designate not the first day, but the last day of 1911.

It is suggested that the calendar proposed above be considered as becoming effective on Sunday, January 1, 1956; that it be called *Peace Calendar* and its inauguration mark the beginning of permanent peace among the civilized nations, time thereafter being designated P.C., when necessary to distinguish from O.S. or N.S.

Cyril G. Hopkins
University of Illinois,
December 1, 1910

AMŒBA MELEAGRIDIS

To the Editor of Science: In a recent issue of Science[1] Dr. Theobald Smith makes certain comments on a recent published report[2] by the undersigned, in which he dissents from the position taken by us regarding the relation of blackhead in turkeys to avian coccidiosis. Little is to be gained by a controversial discussion which makes no mention of details, and such will not be undertaken in this communication, but there are one or two points in Dr. Smith's communication which deserve notice.

The writers made observations which showed the relation of coccidiosis to certain cases of blackhead, and demonstrated what they believed to be the relation of *Amœba meleagridis* to the coccidium described. The evidence for the conclusions can not be repeated here; for the details the reader is referred to the bulletin in question. It may be said, however, as a result of further investigations by one of the writers, that some confusion probably existed between certain stages of the coccidium and stages in the development of certain flagellated organisms, but neither the earlier observations of the undersigned, nor any that have been made more recently by one of the writers, have given any warrant for assuming the existence of *Amœba meleagridis*. The reasons for not so considering the organisms found in the diseased tissues of turkeys affected with blackhead are stated in full in the report, and the only evidence which Dr. Smith has brought forward as supporting a contrary view, since the publication of his first description in 1895, is given in a foot-note to his recent communication (*loc. cit.*, p. 512),

[1] 1910, N. S., Vol. XXXII., No. 824, October 14, pp. 509–512.

[2] "Blackhead in Turkeys: A Study in Avian Coccidiosis," Bull. 141, Rhode Island Agricultural Experiment Station, 1910.

in which he says: "Amœbic changes in form have been noted recently in liver tissue [sic] examined *immediately after chloroforming affected turkeys*" (italics as in original). It is to be presumed that reference was meant to the parasites within the tissues. Dr. Smith is of the opinion that the varied etiological conditions encountered in the different species of birds, and in turkeys at different ages, leads to a conclusion that two distinct diseases were encountered and confused. It does not, however, seem to the writers that a different expression of the effects of a disease among various species, or in the same species at different ages, is anything remarkable. Furthermore, it was specifically stated that other complications were a common accompaniment of the coccidial infection, and one other organism was mentioned which, it was suggested, had the power to produce pathological conditions characteristic of blackhead.

Regarding the relation of the coccidium observed in blackhead to *Coccidium cuniculi*, the great variability in the shape and size of the cysts led to the tentative conclusion that the two were not to be separated on purely morphological grounds. On page 203 of Bulletin 141 appears the following:

> It may be here stated that the present writers (Cole and Hadley, 1908) have, in the past, used the name *Coccidium cuniculi*, merely to signify the *morphological* [italics not in original] resemblance to this organism. . . .

As to the biological tests, some inconclusive experiments are reported on p. 183, and on p. 203 it is said:

> Experiments involving such tests are now under way at the Rhode Island Experiment Station, and until their results are clear, the authors do not feel justified in attempting to place the organism of blackhead [*i. e.*, the *Coccidium*] in its proper systematic position.

Furthermore, the position taken in Bulletin 141 regarding roup as a coccidial disease is merely suggestive—on account of the similarity to the schizont stage of a coccidium of certain histological elements found in roup lesions—and in no sense positive. For example, it is stated on p. 205 that it "seems possible" that what Harrison and Streit figure as "swollen nuclei" may represent stages in the development of a coccidium; and again, on p. 206, it "seems possible" that the "refractive bodies" described by Cary may also be shizont stages of coccidia.

In closing, Dr. Smith (*op. cit.*) remarks:

> I also wish to protest against the publication of premature, undigested, controversial statements in the form of preliminary notices years before the appearance in print of the actual work on which such statements are presumably based.

It is certainly much to be regretted that the appearance of the full bulletin was long delayed awaiting the production of plates. It should be stated, however, that the "preliminary communication" referred to by Dr. Smith was not a special article on the subject. It was merely the *abstract* of a paper read at the scientific meetings at New Haven and Chicago; and, as such, partook of the abbreviated form characteristic of most other similar abstracts printed in SCIENCE. Needless to state, much "proof" could not be supplied in an article necessarily of so short a nature.

LEON J. COLE
PHILIP B. HADLEY

QUOTATIONS

WOMEN AND SCIENTIFIC RESEARCH

IT is a long time since so interesting a phase of the question of woman's place in the world of intellect has come up as that presented by the proposition that Mme. Curie be elected a member of the Académie des Sciences. Of course, nothing really analogous to this case has yet arisen in the course of the advancement of women that has been so remarkable a part of the history of the past generation; there is something more dramatic about the situation presented when the most distinguished group of scientific men in the world debates the admission of a woman into its charmed circle than in the gradual extension of the field involved in the opening of the doors of university after university in country after country, to women students. As for the merits of the case, and its probable outcome,

we can not help feeling that it is at most only a question of time when Mme. Curie's admission will be effected; assuming, as no doubt it may be assumed, that the opposition turns only on the question of sex. It is hardly to be supposed that this will be allowed, in our time, to prevent for very long the recognition of achievements of such unusual character, and of such extraordinary importance in the history of science, as those which she has accomplished. Incidentally, it may be remarked that to the logical mind there will be little to choose between her admission and her non-admission, as an argument against the views of those who still maintain that experience has shown women's incapacity for the highest forms of scientific production. If she is admitted, there will be one woman, out of the handful that devote their lives to scientific research, distinguished by one of the highest of scientific honors; if she is kept out, it will be one more proof of the immeasurable difference between the degree of encouragement and incentive held out to women and that held out to men for sustained devotion to strenuous intellectual labors.—*The N. Y. Evening Post.*

SCIENTIFIC BOOKS

An Introduction to the Theory of Optics. By Arthur Schuster, F.R.S., Honorary Professor of Physics at the University of Manchester. Second edition, revised. London, Edward Arnold. 1910.

The first English text-book on physical optics which had any considerable utility for college classes is probably that of Glazebrook, published in the early eighties. Of the many other texts and treatises on this subject which have appeared since there is probably none which shows better balance or more accurate scholarship than the one of which the second edition is now under review.

We pass at once to some of the noteworthy features of this treatment, and especially to the changes introduced into the second edition, merely pausing to commend the author's clarity and precision of style.

1. A nomenclature which has once been established and which carries with it a perfectly definite meaning is difficult to replace. But every one must admit the cogency of Professor Schuster's reasons for suggesting that we replace the term "simple harmonic motion" by "simple" or "normal" oscillation, since "*harmony* means a relation between different things and not a property of any particular thing."

The term "quasi-homogeneous," which does not appear in the former edition, is here introduced to denote actual monochromatic radiations met with in the laboratory as contrasted with the hypothetical (homogeneous) radiations described by the following equation, in which x is unlimited as to value:

$$y = a \cos 2\pi(t/T + x/\lambda).$$

As an illustration of the helpfulness of this concept one may refer to the last paragraph of art. 26, which is much clearer than the corresponding paragraph in the older edition; or one may cite the following sentence from the chapter on gratings:

> It is owing to the rapid falling off of light from both sides of the principal maxima, that the grating can be made use of to separate the different components of white light, and to produce quasi-homogeneous vibrations.

Another helpful term suggested (p. 60) in the new, but not in the old, edition is the word "coherent" to denote "vibrations which are related in phase owing to their having originated at the same ultimate source."

The following quantitative definition of spectral purity appears in a new form; but it is hardly self-contained or definite without additional explanation. Spectral purity is defined "as $\lambda/\delta\lambda$ where $\delta\lambda$ is the difference between two wave-lengths which just do not encroach upon one another."

2. In Chapter III. will be found a most instructive page of new material giving a comparison of the two methods of resolving white light, namely, into pulses and into homogeneous waves. The essence of the matter is contained in the following paragraph:

> The consideration of white light as a succession of impulses is very instructive and often simplifies calculations considerably, as we need only deal with a single impulse; while if we start from the

homogeneous vibration we have to perform the summation for all wave-lengths before we can arrive at a final result. It must be noted that we are at present not concerned with the question how the light originates; we take the disturbance as it is and try to represent it analytically, and just as there are many ways of resolving a system of forces so there are many ways of resolving the motion of light into elements with which we can deal analytically. The resolution by homogeneous waves is one, the resolution by impulses another. Whenever the two methods seem to yield different results a mistake has been made in their application.

The usefulness of this view-point is well shown in art. 64, where the author explains how a grating may impress its own periodicity upon a luminous impulse just as a picket-fence may turn an atmospheric impulse into a musical note.

3. The curiosity of every reader can hardly fail to be stimulated by the last sentence in the author's new preface, which runs as follows:

My thanks are due to various friends and correspondents who have kindly pointed out a number of errors, which were left standing in the previous edition—but I feel a consoling though unmerited sense of satisfaction at the one serious blunder having remained unnoticed, and, I hope, undetected.

One change which the author introduces into his treatment of interference is so radical as to make one ask whether the remark just quoted from the new preface does not refer to the following sentence from p. 54 of the previous edition:

There may, therefore, be interference of intensity, though there is no interference of displacement.

The new and precise definition of interference which replaces this idea in the later edition is as follows:

If the observed illumination of a surface by two or more pencils of light is not equal to the sum of the illuminations of the separate pencils, we say that the pencils have interfered with each other and class the phenomenon as one of interference (p. 57).

The advantage derived from the adoption of this definition is obvious on reading art. 35.

4. A new section on the interferometer of Fabry and Perot is an addition of distinct value.

As to the mathematical treatment, it may in general be described as clear and elegant. There are, however, some distinct exceptions to this statement, of which the following instance will serve as a type. The neat elementary discussion of diffraction on p. 95 would be distinctly improved by deriving, instead of assuming, the value of the intensity factor $2/\pi$.

Among the striking omissions in the two chapters on diffraction is any mention of Cornu's spiral.

If the student is to be considered, the value of the book might be greatly enhanced by throwing into heavier type many of the more important results. To illustrate, the fundamental theorem, that "the brightness of the image [of a luminous surface] is equal to $IS\omega/s$," is buried in the context of p. 152 without comment. Much time and energy are saved the student when matters of first importance are emphasized in some way.

The index is very meager and cross-references contain numerous errors. It is to be hoped both of these may be corrected before the next printing and without waiting for a third edition.

The shifting of the article on Talbot's bands from the chapter on the Nature of Light to that on Diffraction is interesting in view of the two explanations of these bands recently given by the author and by Professor R. W. Wood.[1]

Even though this review is intended to deal mainly with the differences between the first and second editions, there are many other features in this admirable treatment which one can scarce resist commending. As an example may be mentioned the chapter on Rotary Effects, in which an excellent notation, description of phenomena and quantitative discussion are condensed into a few brief, but lucid, pages.

HENRY CREW

[1] *Phil. Mag.*, 7 and 18.

Causal Geology. By E. H. L. Schwarz, Professor of Geology at the Rhodes University College, Grahamstown, South Africa. Glasgow, Blackie & Son; New York, D. Van Nostrand Company. Pp. 248, with numerous figures and plates. $2.50.

The aim of this treatise is set forth by the author in his preface in the following words:

> In the ten years spent on the Geological Survey of the Colony of the Cape of Good Hope I was brought into contact with most of the geological problems that are presented by our earth in a way which, I believe, is afforded nowhere else. The whole country, practically, is bare of soil and the rocks lie ready to the hammer everywhere, while the enormous gashes sawn through the land by the rivers reveal sections of unparalleled magnitude and clearness. As year by year went by the facts presented themselves to me in an order different from that stated in the text-books, and the theories as to their origin and nature became simplified and different from established ones. There seemed to me no need to speculate on enigmatical problems, but the facts observed, if allowed to arrange themselves according to their natural sequence, explained many of the problems that are the subject of so much controversy. I feared that in the isolation from centers of current geological thought I had gone off on a side track which led nowhere, but the publication of Professor T. C. Chamberlin's "Planetismal Hypothesis"[1] showed me that I was traveling in a direction which, at least, was being taken by others. The planetismal hypothesis allows known facts to weigh more than theories, and enables one to build up a system of geology without an appeal to the unknown and unknowable. It is not for me to judge the merits of this hypothesis, but in my opinion it is the most positive advance in natural science that has been made for a very long time. . . . In many cases I have gone much further than Professor Chamberlin, but the object I have set before me is to lay the whole case from the single point of view of a solid earth.

The author in the first chapter makes five postulates concerning which he remarks that, while he can not prove them, "they are general conceptions which follow naturally from the investigation of geological phenomena and that where current ideas differ from them there has interposed between the fact and the conclusion theories brought in from other sciences or developed within the domain of geology, and these have served as a screen which has blurred the outline of objects."

These are: (1) That the rocks of the earth's crust are in constant motion. (2) That the force of cohesion in rocks is insufficient to keep them rigid when in large masses, the rotational force of the earth being thus quite competent to mould the cold and solid earth into the shape which it possesses—that which would be adopted by a revolving fluid mass. (3) That the area of the surface of the globe is not a diminishing one. (4) The surface of the earth is uniform in average texture throughout. The continental masses are thus not relatively lighter than the suboceanic portions of the earth's surface and the theory of the permanence of ocean basins must be abandoned. (5) That the earth is growing by the addition of meteoric matter and the composition of the earth, as a whole, is represented by the average composition of this matter. While this is true, the exterior portion of the earth's crust has been worked over and over by processes of weathering and erosion during which the more soluble substances, principally iron and magnesium, have been carried away in solution downward, toward the earth's center, leaving behind a residue more siliceous than the average composition of the globe.

Taking these postulates which he considers to be true, as granted, the author then explains the geological processes at work within the earth and upon its surface. The accession to the material of the earth's surface by the fall of meteorites is considered at length and in the case of Coon Butte it is stated that there seems to be no reasonable doubt that this crater is actually the result of the impact of a huge bolide. Turning then to the moon as illustrating a stage in the earth's evolution, the author considers that the hypothesis which best explains the *maria,* is that great meteors fell upon the moon, and by their impact pro-

[1] T. C. Chamberlin, "Year Book Carnegie Institution," No. 3, 1905, pp. 208–253; T. C. Chamberlin and R. D. Salisbury, "Geology," "Earth History," Vol. II., London, 1906, pp. 38–81.

duced sufficient heat not only to melt up their own substance, but a good deal of that comprising the adjacent lunar surface, and then adds "having established then the fact that giant meteors may have fallen on the earth and may have melted up tracts of country which would be deluged with lava—we may legitimately enquire whether there are any evidences of such occurrences on the earth's surface." He considers that the tufas, lavas and agglomerates in the Archæan of Great Britain, the great lava sheets of the Snake River in Idaho and those of the Kapte Plains of British East Africa may eventually prove to have had such an origin. It is even considered a by no means impossible theory that the New Caledonian nickel deposits are portions of a gigantic meteor which fell long ages ago and which by earth movements has been so crushed and folded that it has all the appearance of an igneous dyke.

The origin of the water on the earth's exterior and the part which it plays in modifying the earth's surface, is then taken up and the recent work of various investigators is well presented and discussed. In referring to the fact that during the weathering of rocks the lime which they contain tends to go into solution more readily and thus to be more completely removed than the associated magnesia, the author gives it as his opinion that in the processes of solution and redeposition the lime tends to pass upward and outward in the earth's crust while the magnesia most frequently passes downward, and adds "Why it goes downward is at present entirely a mystery; from an analogy with iron one might suggest that the magnesium of the earth's nucleus exerts an attraction and thus draws it downward," for the author holds that when compounds of iron are dissolved they become ionized and that the great central mass of metallic iron within the earth "must thus exert a pull on the iron in solution, and this pull lasting over innumerable myriads of years, yet ever persistent and increasing, would gradually draw downwards the ions of iron as they become formed in the surface water of the earth."

In treating of the work of underground water, Mr. Schwarz accepts Posepny's theory of the origin of ore deposits and believes it to be the explanation which is now adopted by an ever-increasing body of geologists.

The subjects of earth folds, the earth's surface, cold volcanoes, normal volcanoes, earthquakes and Archæan rocks are then taken up in succession. Many statements are made which are highly debatable and some of which are certainly incorrect. The book, however, is well written and is worthy of perusal by all geologists interested in the fundamental problems of the origin of the globe, although one can hardly agree with the author when he says that the work "constitutes an appeal for a return to rationalism after a period of romanticism," for in it the romantic element is developed in a manner as striking and interesting as in any of the modern treatises of the more orthodox school.

FRANK D. ADAMS

A Text-book of Psychology. By EDWARD BRADFORD TITCHENER. New York, The Macmillan Co. 1910. Pp. 565.

The review of a text-book, like the book itself, reflects a personal equation. The fate of a text is a venture, sharing somewhat in the psychology of advertising. However good the article or inviting the appeal, the test comes in its reception. It is legitimate to appraise a text in terms of its intrinsic merits in form and content and execution; it is equally legitimate to consider its service. For the purpose of ever so good a text is bound up with its use. It must first appeal to the instructor; yet he tests it practically and is prepared to revise his judgment. The comments of the users might be gathered by the questionnaire method, with anonymity to secure frankness of statement.

In a science like psychology, with traditions in the making and doctrines appreciably shifting, yet with essential principles of large scope and sufficient definiteness, the makers of text-books have wide latitudes. It is easy to find agreement that the purpose of the text is to help the student from a casual to a system-

atic and more adequate understanding of the mental processes. There is little agreement as to the best means of accomplishing it. Each in his way assents that such helpfulness must respect the attitude of the student, while yet exercising to the full the privileges of wise and even stern leadership. Any given text is the author's advocacy of the ways and means he regards as best suited to set the youthful mind psychologizing with greatest profit. These platforms differ decidedly, and as Professor Titchener indicates, are dependent upon temperament. Yet his own classification of texts is more a matter of policy. He notes three types: those that adhere to systematic principles and make much of traditional observation; those that simply compile experimental data; those that lean heavily on experiment but interpret conclusions in theoretical analysis. His own text belongs to the last group.

Objectively it is readily described. The present volume replaces the "Outlines of Psychology" (1896), shows a thorough rewriting with much use of recent reconstruction, and carries out yet more rigidly the determination to "set experimental methods and results in the forefront of discussion." This decision is reflected in the space distribution of topics. Two fifths of the text is devoted to Sensation and assumes a knowledge of the sense-organs. (The functions of the nervous system are omitted as equally to be elsewhere acquired.) Affection together with Attention occupies seventy-five pages; and the same space is devoted to Perception. Something less than a third of the pages consider Association, Memory, Imagination, Action, Emotion and Thought. The psychology is structural; and construction lines and architectural details are emphasized; the theories of their interpretation professionally discussed; the technique of method expounded. The student is taken in hand as one ready to proceed as far as he can, toward the same kind of insight and interest that the professional psychologist has acquired. There is good precedent for this attitude in the texts of other experimental sciences. No one is better equipped to lay out such a course than Professor Titchener. Those who agree with him that this is the course to be pursued may unhesitatingly adopt his text as an able, judicious and logical guide. Even more may be added: so adequately does this text represent what can and should be done and said and considered in conformity with the fundamental position of the author, that the entire method may be said to stand on trial in this volume. It represents the best products of ripe scholarship and of the comprehensive utilization of recent advances. Professor Titchener informs us that the present volume was insistently demanded by colleagues and pupils and publisher. Let that answer for the service which it has performed and is destined to perform.

The present reviewer has no desire to intrude his personal equation unduly. Though he shares with Professor Titchener the confidence in the value of the experimental data, and in the attitude thus enforced, he takes his stand with those who believe that a very different kind of text-book will alone serve the pedagogical purposes in view. In the emphasis of the functional aspects of mental phenomena; of their setting in common experience and observation; of the thoroughgoing acquisition of principles (quite enough of which are sufficiently established for the student's needs); of the avoidance of refined details and controversial positions; of the minimizing of theoretical dissection; of the provision of a fair perspective of the field of mind as a living, significant part of the world; in all this and much more he takes his stand with the other wing of the psychological party. In an experience with several thousand students, he recalls but a handful willing or able to absorb such psychological proficiency as they aspired to, through the plans and specifications furnished by this order of text. He believes that psychology presents as characteristic differences from as points of community with the instructional methods of other sciences; that the text-book writer may more safely overrate the distinctions than the resemblances. Both in view of students as they are, and of instruction functionally consid-

ered, he regards the demand for an almost diametrically opposed type of presentation as justified. None the less, he is grateful for the availability of so admirable a text, written under so different an inspiration. The student with a fair foothold on the subject will here find the means of strengthening his grasp upon the problems arising specifically from the experimental issues.

JOSEPH JASTROW

LOUIS AGGASIZ'S LATER VIEWS ON THE CLASSIFICATION OF FISHES

WRITERS on ichthyology have expressed two distinct views concerning Louis Agassiz's work on the fishes. On the one hand, they have praised his contributions to descriptive ichthyology and his masterly work on the fossil forms; on the other, they have condemned his classification—declaring that a system which rests solely upon differences in scales is superficial and unphilosophical, and, even for his day, was a step backward, rather than forward.

But in thus condemning Louis Agassiz's views an injustice is done him, for he is credited only with the classification he elaborated early in life (in his "Poissons Fossiles," 1833–1844), but later abandoned and, in fact, repudiated. No cognizance is taken of his maturer views expressed many years later, at a time when he had ceased to contribute in any marked degree to the descriptive side of his science. One reason for this neglect of his later views is the fact that they were not elaborated in detail, but presented in bare outline before various societies; and are scattered in a dozen or two paragraphs through the proceedings of these societies. It is worth while, it seems to the writer, to bring together these later views of Agassiz and to indicate the steps by which he arrived at them.

As is well known, Louis Agassiz's larger works on the fishes were published in Europe. After coming to America he occupied himself chiefly with the invertebrates. None the less he never lost sight of his favorite group and continued his observations in it whenever opportunity offered. But he worked at so many subjects and with such haste that he never found time to elaborate all these observations. Except for three or four short papers[1] in which results were presented in more or less detail, his views on the fishes were set forth briefly. In the Proceedings of the American Academy of Arts and Sciences, and of the Boston Society of Natural History, during the fifties and sixties, are scattered numerous condensed records of his observations, some of great interest.

His earliest allusion to his first classification is found in a communication which he made in 1850[2] to the American Academy of Arts and Sciences, on the scales of the bonito. He showed that these scales are intermediate between the *ctenoid* and the *cycloid* types, the serrations being marginal only and not traversing the whole posterior portion of the scale.

In 1857[3] he announced that he had given up the classification of fishes by their scales and proposed a new classification which he said was founded upon embryological characters—although he did not specify what these characters were. He divided the fishes into four *classes:* (1) Selachians, (2) ganoids, (3) fishes proper, (4) myzonts [= cyclostomes].

This system, if we allow for the changes wrought since Agassiz's day in the group of the ganoids, is not much different from our modern ones. In ranking his groups as classes he was ahead of his time. There is a tendency at the present day to make the Cyclostomes and the Selachians, classes,[4] equivalent in rank to the class Pisces proper. Such a view, for instance, has recently been urged by Gill and, as far as the Selachians alone are

[1] A summary of these is given by Jordan in his "Agassiz on Recent Fishes," in the *American Naturalist*, XXXII., 1898, pp. 173–176.

[2] *Proceedings*, II., p. 238.

[3] *Proceedings Academy Arts and Sciences*, IV., pp. 8–9.

[4] It does not appear that Louis Agassiz used the word class with precisely the same connotation as given to it to-day. It was then used somewhat more loosely. However, this does not depreciate the value of his conclusion that these four groups are of equivalent rank.

concerned, also by Hubrecht and by Regan. Doubtless a similar view is held by other ichthyologists at the present time.

The arrangement of the fishes continued to exercise Agassiz during succeeding years. In 1858[5] he read a communication before the American Academy of Arts and Sciences advocating the classification of fishes by the structures of the mouth as related to the facial bones. And as late as 1867 he again occupied himself with fishes, reading, in that year,[6] a paper on the classification of the catfishes.

In the light of present knowledge this classification of the catfishes was not a happy one. He regarded the group as "an order of ganoid fishes which should be placed between the sturgeons and the garpikes." He based this view, he tells us, on resemblances in the brains of the catfish and the sturgeon; but he seems to have been unduly impressed by the South American armored catfishes. To be sure such forms as *Loricaria* and *Plecostomus* are in some regards suggestive of the sturgeon; but the resemblances are now looked upon as mere parallelisms and not as signs of relationship.

In conclusion: Louis Agassiz deserves greater credit for his later than for his earlier classification of the fishes. He sought to base it on facts of anatomy and embryology and not, as with the earlier classification, on a single superficial character. And in ranking the groups as classes and in raising the selachians, cyclostomes and fishes proper, to equivalent rank, he was the forerunner of our modern views.

L. Hussakof

[5] *Proceedings Academy Arts and Sciences*, IV., p. 108.

[6] *Proceedings Boston Society Natural History*, XI., p. 354.

THE SYNTHESIS OF FORMALDEHYDE BY LIGHT WITHOUT CHLOROPHYLL

Readers of Science will be interested in the achievement by chemists of the duplication of the first step in the synthesis of carbohydrates by plants. Many years ago it was found that formaldehyde, when made slightly alkaline, transformed itself spontaneously by a series of condensations into a mixture of sugars called "formose," but the first step in the process of the synthesis of the sugars, namely, the synthesis of formaldehyde from carbon dioxide and water with the liberation of oxygen it has been impossible to achieve under conditions at all comparable to those prevailing in plants. This synthesis has now been obtained by Berthelot and Gaudechon[1] by means of ultraviolet light.

A mixture of carbonic anhydride and water under the influence of these rays liberates oxygen and produces carbon monoxide and formaldehyde. Carbon monoxide and water so illuminated produce carbon dioxide, carbon monoxide, hydrogen and formaldehyde.

Moreover, glucose under similar conditions gives rise, among other things, to marsh gas, hydrogen and carbon dioxide.

It seems not impossible, in view of these facts, that the rôle of the chlorophyll may be the transformation of the longer wave-lengths of light to shorter more active ones, thus acting in a photodynamic way, as frequently suggested.

A. P. Mathews

[1] "Synthése photochemique des hydrates de carbone aux dépens des elements de l'anhydre carbonique et de la vapeur de l'eau en l'absence de chlorophyll, etc.," *Comptes Rendus de l'Acad. de Sci.*, 150, 1910, p. 169.

SPECIAL ARTICLES

NOTE ON THE DISTRIBUTION OF SOME PENNSYLVANIA FISHES

While angling at Valley Forge, on September 27, 1910, I caught a number of small fishes in Valley Creek, a tributary of the Schuylkill River. As several of these have not been found before so far to the east in Pennsylvania, I take this opportunity of recording them. These are *Pimephales notatus* and *Exoglossum maxillingua*. Along sloping shores in shallow water were very numerous large schools of small fishes, which I found to be mainly the young of the preceding, though *Abramis crysoleucas, Notropis bifrenatus, N. cornutus, Fundulus diaphanus, Lepomis au-*

ritus, Eupomotis gibbosus and *Boleosoma nigrum olmstedi* were also common.

I have received a collection of the following from a stream draining Lakemont Park Lake at Altoona, in Blair Co., on August 5, 1910, sent by Mr. H. L. Mather, Jr. *Pimephales notatus, Semotilus atromaculatus, Notropis whipplii analostanus, N. cornutus, Rhinichthys cataractæ, R. atronasus, Exoglossum maxillingua, Catostomus nigricans, Erimyzon sucetta oblongus, Schilbeodes insignis, Eupomotis gibbosus* and *Boleosoma nigrum olmstedi.* The occurrence of *R. cataractæ* is of interest, and although locally abundant, I have met with it in but few and widely separated localities. Another instance was on August 27, 1910, in the Bushkill Creek at Easton, where I also found *Anguilla chrisypa, Semotilus atromaculatus, Abramis crysoleucas, Notropis bifrenatus, N. cornutus, Rhinichthys atronasus, Catostomus commersonnii, Erimyzon sucetta oblongus, Boleosoma nigrum olmstedi* and *Cottus gracilis.*

HENRY W. FOWLER
ACADEMY OF NATURAL SCIENCES,
PHILADELPHIA, PA.,
October 31, 1910

THE CONVOCATION WEEK MEETINGS OF SCIENTIFIC SOCIETIES

THE American Association for the Advancement of Science and the national scientific societies named below will meet at Minneapolis, during convocation week, beginning on December 27, 1910.

American Association for the Advancement of Science.—Retiring president, Dr. David Starr Jordan, of Stanford University; president, Professor A. A. Michelson, University of Chicago; permanent secretary, Dr. L. O. Howard, Smithsonian Institution, Washington, D. C.

Local Executive Committee.—Wilbur F. Decker, chairman; Frederic E. Clements, secretary; Leroy J. Boughner, Frederic B. Chute, James F. Corbett, James F. Ells, Wallace G. Nye, Henry F. Nachtrieb, Edward E. Nicholson, Francis C. Shenehon, Albert F. Woods, Frederick J. Wulling.

Section A—Mathematics and Astronomy—Vice-president, Professor E. H. Moore, University of Chicago; secretary, Professor G. A. Miller, University of Illinois, Urbana, Ill.

Section B—Physics.—Vice-president, Dr. E. B. Rosa, Bureau of Standards, Washington, D. C.; secretary, Professor A. D. Cole, Ohio State University, Columbus, O.

Section C—Chemistry.—Vice-president, Professor G. B. Frankforter, University of Minnesota; secretary, Professor C. H. Herty, University of North Carolina, Chapel Hill, N. C.

Section D—Mechanical Science and Engineering—Vice-president, Professor A. L. Rotch, Blue Hill Meteorological Observatory; secretary, G. W. Bissell, Michigan Agricultural College, East Lansing, Mich.

Section E—Geology and Geography.—Vice-president, Dr. John M. Clarke, state geologist of New York, Albany, N. Y.; secretary, F. P. Gulliver, Norwich, Conn.

Section F—Zoology.—Vice-president, Professor Jacob Reighard, University of Michigan; secretary, Maurice A. Bigelow, Columbia University, New York, N. Y.

Section G—Botany.—Vice-president, Professor R. A. Harper, University of Wisconsin; secretary, H. C. Cowles, University of Chicago, Chicago, Ill.

Section H—Anthropology and Psychology.—Vice-president, Professor Roland B. Dixon, Harvard University; secretary, George Grant MacCurdy, Yale University, New Haven, Conn.

Section I—Social and Economic Science.—Vice-president, the Hon. T. E. Burton, Cleveland, Ohio; secretary, Fred. C. Croxton, 1229 Girard Street, Washington, D. C.

Section K—Physiology and Experimental Medicine.—Vice-president, Professor F. G. Novy, University of Michigan; secretary, George T. Kemp, Hotel Beardsley, Champaign, Ill.

Section L—Education.—Vice-president, President A. Ross Hill, University of Missouri; secretary, Charles Riborg Mann, University of Chicago, Chicago, Ill.

Permanent Secretary (for five years)—Dr. L. O. Howard, Washington, D. C.

General Secretary—Professor Frederic E. Clements, University of Minnesota.

Secretary of the Council—Professor John Zeleny, University of Minnesota.

American Mathematical Society (Chicago Section).—December 28–30.

American Federation of Teachers of the Mathematical and Natural Sciences.—December 28–29. President, Professor C. R. Mann, University of Chicago; secretary, Eugene R. Smith, Polytechnic Preparatory School, Brooklyn, N. Y.

The American Physical Society.—President, Professor Henry Crew, Northwestern University; secretary, Professor Ernest Merritt, Cornell University, Ithaca, N. Y.

The American Chemical Society.—December 28–31. President, Professor Wilder D. Bancroft, Cornell University; secretary, Professor Charles L. Parsons, New Hampshire College, Durham, N. H.

The American Society of Zoologists (Central Branch).—December 29–30.

The Entomological Society of America.—December 27–28. President, Professor John B. Smith, Rutgers College; secretary, C. R. Crosby, 43 East Avenue, Ithaca, N. Y.

The Association of Economic Entomologists.—December 28, 29. President, Professor E. D. Sanderson, Morgantown, W. Va.; secretary, A. F. Burgess, Melrose Highlands, Mass.

The Botanical Society of America.—December 28–31. President, Dr. Erwin F. Smith, U. S. Department of Agriculture; secretary, Dr. George T. Moore, Missouri Botanical Garden, St. Louis, Mo.

Botanists of the Central States.—Secretary, Dr. Henry C. Cowles, University of Chicago, Chicago, Ill.

American Phytopathological Society.—December 28–30. President, Dr. F. L. Stevens, North Carolina College of Agriculture and Mechanic Arts; secretary, Dr. C. L. Shear, U. S. Department of Agriculture, Washington, D. C.

American Microscopical Society.—December 28, 29. Secretary, Dr. Thomas W. Galloway, James Millikin University, Decatur, Ill.

American Nature Study Society.—January 1. President, Professor Otis W. Caldwell, University of Chicago; secretary, Professor Fred L. Charles, University of Illinois, Urbana, Ill.

Sullivant Moss Society.—December 27–28. Acting secretary, Dr. George H. Conklin, 1204 Tower Avenue, Superior, Wis.

The American Psychological Association.—December 29–31. President, Professor J. H. Pillsbury, University of Michigan; secretary, Professor A. H. Pierce, Smith College, Northampton, Mass.

ITHACA

The American Society of Naturalists.—December 29. President, Dr. D. T. MacDougal, Desert Botanical Laboratory, Tucson, Ariz.; secretary, Dr. Charles R. Stockard, Cornell Medical School, New York City.

The American Society of Zoologists (Eastern Branch).—December 28–30. President, Professor Thomas H. Montgomery, Jr., University of Pennsylvania, secretary, Dr. Herbert Rand, Harvard University, Cambridge, Mass.

The Association of American Anatomists.—December 28–30. President, Professor George A. Piersol, University of Pennsylvania; secretary, Professor G. Carl Huber, 1330 Hill St., Ann Arbor, Mich.

The Society of American Bacteriologists.—December 28–30. President, Professor V. A. Moore, Cornell University; secretary, Charles E. Marshall, Michigan Agricultural College, East Lansing, Mich.

NEW HAVEN

The American Physiological Society.—December 27–29. President, Professor W. H. Howell, Johns Hopkins University; secretary, Professor A. J. Carlson, University of Chicago.

The American Society of Biological Chemists.—December 28–30. President, Thomas B. Osborne, Connecticut Agricultural College; secretary, Dr. Alfred M. Richards, University of Pennsylvania, Philadelphia, Pa.

PITTSBURGH

The Geological Society of America.—December 29, 31. President, Dr. Arnold Hague; secretary, Dr. E. O. Hovey, American Museum of Natural History, New York City.

The Association of American Geographers.—December 29–31. President, Professor Henry C. Cowles, University of Chicago; secretary, Professor Albert P. Brigham, Colgate University, Hamilton, N. Y.

The American Paleontological Society.—December 28–29. Secretary, Dr. R. S. Bassler, U. S. National Museum, Washington, D. C.

PROVIDENCE

The American Anthropological Association.—December 28–31. President, Dr. W. H. Holmes, Bureau of Ethnology; secretary, Dr. Geo. Grant MacCurdy, Yale University, New Haven, Conn.

The American Folk-lore Society.—Week of December 29. President, Dr. Henry M. Belden, University of Missouri; secretary, C. Peabody, Harvard University, Cambridge, Mass.

NEW YORK CITY

The American Mathematical Society.—December 28–29. President, Professor Maxime Bôcher, Harvard University; secretary, Professor F. N. Cole, 501 West 116th St., New York City.